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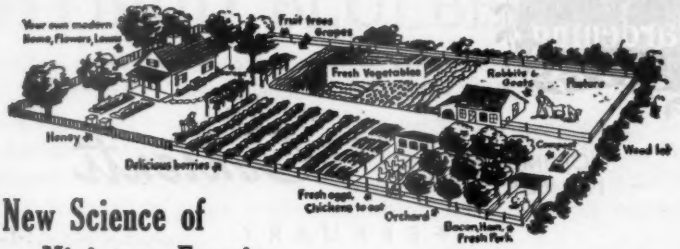

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Organic Gardening

VOLUME 12
NUMBER 2

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HUMUS FROM CITY WASTES

December 2, 1946.

Both in my capacity as owner of the Sunset Nursery and with the City of Reno, I strongly advise compost as a fertilizer. I am now advising the City of Reno to take advantage of its natural supply of humus. My suggestion to them is as follows; Using a feed mill, such as you suggest in your Sept., 1946 issue, grind the leaves gathered from city streets each year and "sludge" from the sewerage system. I use the following proportions; Six inches of ground leaves, two inches ground sludge, two inches fresh manure, one inch of good soil, and a sprinkling of agricultural lime in heaps about eight feet wide at the base, five feet high, and 30 feet long.

Would you be so kind as to tell me what you think of the above, and I would appreciate any suggestions you have to offer.

Jack J. Varnum,
Sunset Nursery Co.,
465 Quincy Street,
Reno, Nevada.

—o—

SOME AGREE

July 22, 1947.

I noted recently some adverse criticism on the subject of repetition in your columns. Would like to say that constant repetition is the best way to learn anything, and for the sake of new subscribers especially keep it up. The things you repeat are things worth repeating!

We are still a long way from making full use of our composting opportunities, lacking space and proper equipment, but even with the small start

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Mrs. Geo. C. Conive,
Landwehr Road,
Northbrook, Ill.

—o—

CHEMICAL FERTILIZERS REPEL EARTHWORMS

Sept. 30, 1947.

After reading the articles published in Organic Gardening, Pay Dirt, and Compost Preparation, I started a compost pile last spring by using weeds, grass cuttings, garbage, chicken manure, and lime and used the finished compost in my garden this year with results more to my satisfaction than the chemical fertilizers which I had been using in former years. Apparently the fertilizers killed all the worms because I did not see any worms when I plowed my garden in the spring, nor did I see any all summer; probably because the months of June and July were deficient in precipitation. However, during August when we had quite a lot of rainfall, I noticed that the worms worked to the surface where I had used the compost.

A. F. Magrum,
312 Grosvenor Lane,
Bethesda 4, Md.

—o—

PAY-DIRT TO COMPOST

September 17, 1947.

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PHOTO: Upright Yew Hedge 10 years after planting 15-18" size (inset).

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of organic gardening. The results of the study of the literature along this line and the practical applications of the methods described were astonishing partly, marvelous. I had 7 rows of pole beans, each 25 feet long, but lost four vines due to the injury of some kind of sucking insect (small, like a mite). Everybody around here was complaining about the black aphids, but we were hardly bothered with them and never used any kind of dust or spray insecticides. I also tried the idea of planting nasturtiums to keep the aphids away, and although I have no conclusive proof that it really works, we found the claim substantiated.

I can also report surprisingly good results from rock-mulching some young fruit trees. All in all, I can only highly recommend this sound, natural way of treating our starving soil.

Alfred A. Huber.

—o—

RAW FOODS PRESERVE TEETH

April 23, 1947.

As I was reading the April issue of Organic Gardening, I found an article of particular interest. It was the one called "Color Values in Vegetables." In the fourth paragraph Mr. Cummings said something about the

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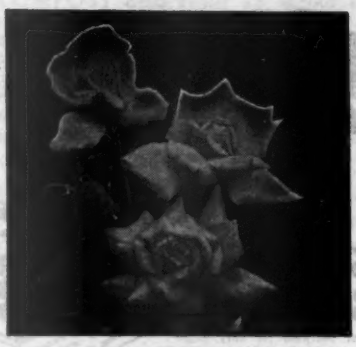
blanching and bleaching processes applied to celery and celeriac parallel to the refinement of flour. He went on to state that these processes did more harm than good. They have on market white bread that has been refined; now the white bread is enriched to put back what was lost in the milling processes. Mr. Cummings also said that the whole or cracked wheat (dark bread) was much better for us nutritionally. I am a firm believer of this and I would like to bring out a point.

A dentist here in town several years ago wanted to find out why people had so much tooth decay; whereupon he went into research. Through his and many others' experiments the medical profession has learned a great deal. Sugar seems to be the cause of most of the decay. This particular man has written several books and many articles on the subject, but people just don't want to give up eating candies and foods heavily sweetened.

The way I look at it is this: Our bodies are no different now than they were thousands of years ago. We had no sugar then and needed none since all vegetables, fruits, and meats have a sugar level that is naturally made. (Here, again, I agree with Mr. Cummings that the closer to nature we live the better for us.) Through the processes such as bleaching and refining the sugar, we have something man-

Brownell Roses



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Preble Cobb,
St. Petersburg, Florida.

—o—

COMPOST VERSUS ARTIFICIALS

July 22, 1947.

The results of a recent experiment in which compost and artificials were compared will interest many of your readers. It was carried out on an area of 22 acres laid down to grass on a farm in Wiltshire. One half of the field was manured with compost, the other with the equivalent amount of artificial manure.

It was agreed with the War Agricultural Executive Committee that six months after the application of the manures the cattle should be turned in and that they should be the judges of the manurial treatment.

When the time came the half herd on the composted area ate all before

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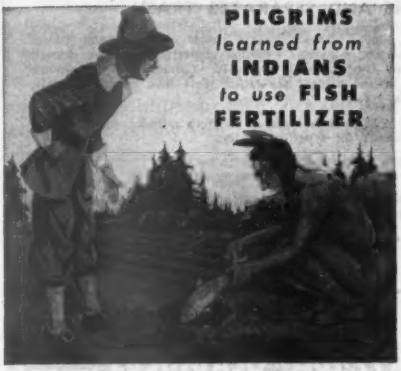

Says Editor J. I. Rodale, in his book "COMPOST and How To Make It"

"We usually advise, when there is a question of a local deficiency in the soil, that certain amendments be used. * * * The perfect thing would be to use seaweed and kelp, also fish cuttings from sea-going fish."

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them. The field was grazed down like a lawn, to the very crowns of the grasses. The milk yield was kept up.

The "artificial" field, which showed a growth equal to the other, was picked at, grazed here and there, messed about and trampled down. A path was worn bare along the dividing fence where the cows on the artificial field walked up and down, coveting the good pasture, albeit short, across the fence. Their milk yield dropped; they sank in flesh; and it was not very many days before disease, viz., mastitis, hitherto entirely absent from the herd, showed itself.

As is well known, the proof of the pudding is in the eating thereof, not in the views and arguments of the cooks. Any who ask if there is any proof that well made compost yields more health-giving crops than artificials have had their answer. Similar trials could be made in America and the results recorded in your journal.

Sir Albert Howard,
London, England.

—o—

COMPOST SOLVED THE GARDEN PROBLEMS

August 1, 1947.

Organic Gardening has been the source of a great deal of pleasure to me and wonderful help in my garden.

I completed my first experiment this year in raising potatoes without commercial fertilizer which I thought I could not do without. The result was the largest crop of the finest potatoes I have ever raised. The most noticeable results have been in peas, carrots, cabbage and broccoli and cantaloupes with the very noteworthy condition of the soil after crops were removed. It was very loose and wonderful to work for fall planting.

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Do Chemical Fertilizers Kill Earthworms?

A hornet's nest of public discussion was recently stirred up by Professor Firman E. Bear, chairman of the Soils Department of the New Jersey Agricultural Experiment Station in a speech delivered June 13, 1947 at the Annual Convention of the American Plant Food Council at Hot Springs, Virginia. This isn't the first time that a bear has tangled with a hornet's nest. In that talk Bear intimated that the "advocates of manurial composts" are incorrect when they state that chemical fertilizers drive away earthworms. His exact words were: "On the New Jersey Agricultural Experiment Station a plot of limed land was planted to Lespedeza sericea. It received a 1000-pound application of 0-12-12 fertilizer an acre at seeding time and 500 pounds an acre every year for the next five years. On November 6, 1946, the number of earthworms in the top six inches of soil on that plot was 1,200,000 an acre, with an additional 90,000 in the second six inches, and 30,000 more in the third six inches.

"Earthworms are no more sensitive to fertilizer than are the root hairs of plants. If temporarily disturbed by an overdose, an earthworm can move but a root hair can't. In general, the heavier the application of fertilizer, within limits, the greater the growth of crops and the larger the amount of crop residues that are left behind in the soil. These provide the food for earthworms."

This short item had an immediate and powerful effect on newspapers and many magazines which were just waiting for such a juicy windfall. *Science Illustrated* came out with a statement, "Gardeners need not hesitate to use fertilizer for fear of killing the beneficial earthworms." Another publication said, "With scientific scorn for contentions that chemical fertilizers are destroying fishing worms, Dr. Bear cited findings of his experiment station to substantiate his claim that fertilizers feed the earthworms." It got as far as California where the California *Citrograph* advised, "Those who say chemical fertilizers kill the 'fish worms' in the soil are all wrong." Incidentally, this was a quotation from the *DuPont Agricultural News Letter.*

Then we were showered with a deluge of letters from our own readers who became worried. One said, "This must not go unchallenged." Another, "Something is wrong, obviously. Who? Are we a group of faddists? Sometimes my doubts are heavy." A subscriber from Texas writes, "I enclose a clipping from the 'Farm Column' of the Beaumont *Enterprise.* You will note the editor quotes the New Jersey Agricultural Station as authority for the statement that 'fertilizers did not have a harmful effect on earthworms.' If this be true, then why go to all the labor of making compost?" He answers this question himself by stating in the next paragraph, "I have been making compost for three years and

have what my friends tell me is the finest garden in this area. It has really worked wonders with my soil." There were hundreds of letters. Meanwhile the newspapers across the entire country seized upon this item with a seemingly fiendish and malicious glee. Newspapers do not check every item that they print, as this would be an impossible task. They must have confidence in what comes out of our great universities. I hope Dr. Bear realizes and never forgets the fact that his pronouncement not only reflected his own opinion but that of the university with which he is associated, a university which is maintained by the citizens of the state of New Jersey. Was this pronouncement in the interest of the citizens who pay Dr. Bear's salary? Let us see. Before proceeding with my attack, because that is exactly what this article is, let me say that one well-known magazine, LIFE, came out with the unequivocal statement in its issue of Sept. 30, 1946 that "The powerful chemical fertilizer, not the robin, is the worms' greatest enemy. In recent years it has poisoned worms in such huge quantities that the world's worm population today has shrunk."

Before a scientist of the standing of Dr. Bear would make such a broad claim you would imagine he would investigate the subject with scientific thoroughness. Dr. Bear has written an acknowledged text-book called *Soils and Fertilizers,* used in many colleges. I have quoted several passages from it in *PAY DIRT*. When he says something, people listen and believe. But in this case he has erred, grossly erred. He has confused an important situation.

1. THE FACT THAT IT IS A SOD-CROP

Let us analyze his experiment. In the first place he has taken a crop, a pasture grass, Lespedeza sericea, which published experiment has shown to be the optimum condition for the flourishing of earthworms. Dr. Henry Hopp and Paul J. Linder described the results of this work in the June 27, 1947 issue of *Science*. Their earthworm study project, which I have visited several times, is still being carried out at the U. S. Dept. of Agriculture Experiment Station at Beltsville, Md. Why didn't Professor Bear make his earthworm count in a plowed corn field? Did he purposely pick a thick-sodded piece of land? I do not know.

The two above-mentioned gentlemen in the article referred to stated, "In recent studies on a Maryland soil, the earthworm population was found to be much lower under annual clean-tilled crops than under sod crops. The reason for this difference has since been investigated, with the purpose of finding a practical means of avoiding the decline in earthworms on annually clean-tilled land. . . . the Table below

Season	Earthworms (Thousands per Acre)		
		Two-Year Rotation	
	Corn Annually	Sod in Spring, Corn in Summer, Wheat in Fall	Wheat in Spring, Sod in Summer, and Fall
Early spring	60	290	85
Late spring	140	290	80
Summer	125	300	75
Early fall	240	440	305
Late fall (after freeze)	85	85	335
Winter	80	60	320

gives the results for plots cropped to corn annually with and without a winter cover and to a two year rotation in which corn is followed by various legumes and grasses. In plots cropped to corn annually the earthworms increased during the growing season until early November. Between November 23 and December 7 a sudden cold period occurred, and most of the earthworms were killed at this time. . . . In the rotation plots that contained a sod of wheat stubble plus legumes and grasses, the earthworms survived."

"These observations indicate that the death of earthworms on the clean-tilled land in the late fall was induced by the sudden drop in temperature to below 32° F. According to observations on three of the plots, this harmful effect can be alleviated by surface protection. These plots were almost bare except for small areas that had been protected with surface coverings of lespedeza hay, soybean residue, and burlap, respectively. The earthworms under the coverings withstood the cold and were highly active.

"Various practical ways of protecting the soil surface against sudden drops in temperature in the late fall may be suggested. Threshing residues, chopped corn stalks, composts, or manure might be spread early in the fall after the row crop has been removed. Where these materials are not available, a fast-growing catch crop that forms a winter mulch might be interseeded at the last cultivation of the row crop."

This clearly shows the inaccuracy of taking a sodded field as an example of the effect of chemical fertilizers on earthworms.

We have confirmed the Beltsville findings on our own farm. In cold weather we found the following condition:

	per sq. ft.
Heavy sod	32 earthworms
Light sod	16 earthworms
Cornfield— with ryegrass cover	8 earthworms
Cornfield— no cover	0 earthworms

Of course in the winter season many earthworms work to lower levels and since these counts are made only in the surface, they are valuable merely for comparative purposes. They *do* show the value of keeping a good cover on the land over the winter. It is a clinching answer also to those who do fall plowing. Please note also in the above figures that a heavy sod had twice as many earthworms as a light one, and then consider the fact that Dr. Bear chose a pure stand of Lespedeza sericea, thus assuring a fine, thick sod.

Dr. Bear gives us a figure of 1,200,000 earthworms to the acre in his sod-field. That may sound high, but it isn't. I have known of cases of 8,000,000 earthworms to the acre where it was treated with compost. Dr. Bear does not give us much information about the history of the field. Were cattle pastured on it before the experiment or even while the project was in progress? Was it heavily treated with dung in previous years? What kind of soil did it consist of? Perhaps on certain poor sandy soils, the outcome might have been far different. If a farm were kept in permanent sod we could prevent the earthworm from disappearing, but in that case where would the world get its corn and potatoes? We must be realistic.

One more point, before proceeding to the next argument. Even the opposition admit that earthworms cannot exist without organic matter. That is an important part of their food. No doubt, in Dr. Bear's field there was sufficient organic matter to keep 1,200,000 earthworms alive per acre. The earthworm swallows the soil, works it through his digestive system and ejects it as castings. In a field enriched only with organic matter the soil going through his body contains no strong chemicals. But in Dr. Bear's field the earthworm is ingesting some chemical with every mouthful of soil. What effect does that have on the body of the earthworm? Dr. Bear has merely counted them. Has he

checked an average number and compared them with earthworms from a field where only organic matter has been used as a fertilizer. In other words, are Dr. Bear's earthworms healthy, or, because their soil contains strong chemicals are they sickish and sluggish in their movements?

This may sound far-fetched, as if I am straining for arguments, but if you consider it carefully you will see that the earthworm has a certain, vital function in the soil. He burrows, creates tunnels, saturates the soil with his secretions. A sluggish earthworm may accomplish only ten or twenty per cent of work as compared with a healthy one. Did Dr. Bear consider this factor? There is a reason why remarkable results are obtained in fields where sufficient, well-made composts, but no chemical fertilizers are used, and we must not leave out of consideration any item of the equation, however insignificent it might seem.

2. WHAT FERTILIZER DID DR. BEAR USE?

It is rather strange that Dr. Bear chose an experiment where no nitrogen was present in the chemical fertilizer used. He used an 0-12-12 fertilizer which means no nitrogen, 12% of phosphorous and 12% of potash. Unfortunately for his experiment, on the average farm over the years, a good deal of nitrogen *is* used as a fertilizer. Farmers' Bulletin No. 1569 issued by the U. S. Dept. of Agriculture says in this regard, "The results of three years' application of ammonium sulphate (which contains much nitrogen) to sod on the experimental farm of the Department of Agriculture at Arlington, Va., for fertilizing purposes, have shown incidentally that earthworms were eliminated from the plots where this chemical was used. When applied to soils which are naturally neutral or slightly acid in character, this fertilizer creates a strongly acid condition that is distasteful to the worms and they disappear." This is the U. S. Government talking and remember, this was a sodded field.

Jack Offerman, Western Vice-President of the American Delphinium Society had an unpleasant experience with earthworms as affected by a chemical fertilizer. Under date of April 25, 1947 he wrote us, "One morning strolling through my garden, I found to my distress a great number of earthworms all dead, laying on the surface of one of the new beds. These worms looked as though they had eaten poison. Later in the day, I found out that my helper had mixed the soil with commercial fertilizer the night before. I knew there was only a small amount of commercial fertilizer in store, but it was sufficient to kill a great number of worms in a bed 4 feet by 80 feet long."

"Since this incident occurred, there will be no more commercial fertilizer used in my garden; the result in growing my delphiniums with compost has been far over my expectation." No doubt this fertilizer contained nitrogen. In California I know that in their irrigation systems the application of liquid ammonia fertilizers which are high in nitrogen cause earthworms to come to the surface and die there immediately. For the one Bear field, we have hundreds which showed that chemical fertilizers definitely reduce the earthworm population materially.

Sir Albert Howard in the introduction to "Darwin on Humus and the Earthworm" (Faber and Faber) said: "In following the ploughs in the autumn and spring in the Spalding area, I always found that where heavy dressings of artificials were used every year, with or without organic matter, earthworms were rare. I sometimes walked half a mile after the ploughs and cultivators without seeing one."

In the *Gippsland* and *Northern Co-Operator* of June 14, 1945, published in Melbourne, Australia is recorded an experience of Percy G. Weston with the use of superphosphate as a fertilizer. "When these flats were ploughed twenty years ago," says Mr. Weston, "they simply teemed with millions of worms. Now the plough reveals that this great friend of

man has vanished or is fast vanishing." In Mr. Weston's case he had row-crops from time to time in his rotation, crops such as corn, tobacco and tomatoes.

Peter D. Barakauskas, teacher of horticulture at The Henry Ford School of Vocational Guidance in Agriculture and Industry read of Dr. Bear's test and was up in arms about it. He wrote me, "My repeated greenhouse tests with earthworms and fertilizers have showed the opposite results that they claim. Earthworms have disappeared from the fertilizer pots, while they have multiplied in unfertilized ones."

We have proved to our satisfaction by field counts of earthworms time and time again that chemical fertilizers are not good for earthworms. Recently we checked it in our greenhouse with the following results:

EARTHWORM EXPERIMENT IN 6" POTS

Started 10 - 9 - 47 — 5 pots of each (10 worms in each pot) — Observations 12 - 4 - 47

	Large Worms	Small Worms	Castings	Capsules
20 ton compost per acre	8	5	xx	xx
15 ton compost per acre	7	1	xx	xx
10 ton compost per acre	6	2	xx	xx
1500 lbs. per acre Sulphate of Ammonia			x	
1000 lbs. per acre Sulphate of Ammonia	2	0	x	0
500 lbs. per acre Sulphate of Ammonia	3	0	x	0
4 - 12 - 4 Fertilizer				
1500 lbs. per acre	0	0	0	0
1000 lbs. per acre	1	0	x	0
500 lbs. per acre	3	0	xx	0
Super Phosphate				
1500 lbs. per acre	4	0	xx	0
1000 lbs. per acre	2	2	xx	0
500 lbs. per acre	2	0	xx	0

xx Plentiful
x Very few

Please note that where chemical fertilizers were used there were no capsules (earthworm eggs).

POISON SPRAYS

A factor which is completely overlooked in Dr. Bear's experiment is the effect of poison sprays on the earthworm population, and since the composters rarely spray, this is an extremely important factor. We have found that DDT is instant death to earthworms. Copper sulphate sprayed on potato plants is poison to the earthworms. Dr. Ehrenfried Pfeiffer writing in his book, "Bio-Dynamic Farming and Gardening" says, "The author has seen vineyards which had been treated for years with copper and lime solutions absolutely devoid of earthworms." Ditto for me on potato fields in our own Lehigh Valley. In his introduction on the Darwin book mentioned above Sir Albert Howard said, "Case after case came under my observation where the continued application of artificial manures and the use of poison sprays like lime sulphur and tar oils for keeping pests of fruit trees in check led to the destruction of earthworms on a colossal scale."

Again Sir Albert Howard says in the same introduction: "The use of artificial manures is not the only modern practice which destroys the earthworm. Hardly less injurious are the poison sprays such as Bordeaux mixture and other powders containing copper salts, tar oils and the lime sulphur washes used for the control of

insect pests. Perhaps the most complete account of such results is that given by Dreidax in the *Archiv für Pflanzenbau,* 7, 1921, and in *Rationelle Landwirtschaft,* Wilhelm Andermann, Berlin, 1927. The first of these papers concludes with a long list of references dealing among other matters with investigations on the earthworm since *The Formation of Vegetable Mould* was published in 1881. In the latter work Dreidax sums up his observations on the deleterious effects of poison sprays on the earthworm population of vineyards in Germany.

"While examining a vineyard situated in the Markgraf near Auggen in south Baden, in which poison sprays were constantly used, he found a surprising fall from the abundant earthworm population of meadows and orchards under grass adjoining the vineyard to that of the vineyard itself. The growth of the vines always corresponded closely with the number of earthworms: the rows next to the grass border were well developed: the vines in the centre of the vineyard, where there were no earthworms, did badly. In this investigation the earthworm population under the grass border invariably stopped dead wherever poison sprays reached the turf.

"A visit to almost any orchard in Kent during the spring immediately after the trees are sprayed with tar oils or lime sulphur will be sufficient to prove how harmful this spraying is to the earthworm population. The ground soon afterwards is covered with a carpet of dead worms."

This doesn't begin to give the evidence we have in refutation of Dr. Bear's experiment, but we don't have the space to present it all.

Water finds its own level. Truth eventually establishes itself. The organic gardening and farming movement is already too strongly intrenched to fear the attacks of the chemical proponents, and before they accept any more experiments of the chemical professors, that they read about in the general press, I am sure they will go back into their files of *Organic Gardening Magazine* where they will find, without too much difficulty, the true facts.

J. I. RODALE.

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Manures, Compost, Manure—Again

By DR. EHRENFRIED E. PFEIFFER

IN a discussion following a lecture to a group of farmers recently, it was said that "Organic Gardening" talks too much about compost. The counter-evidence to this statement appears in quite a few letters which the writer has received since the article "Fermentation versus Putrefaction and Decay" appeared in the September, 1947 issue of *Organic Gardening*. These all contained requests to tell more about compost and manure, in particular how they can be preserved in order to get the right kind of fermentation. Therefore, I dare to write on the subject again at the risk of repeating myself.

In the course of history the theme of manure and humus seems, by the way, to crop up in cycles. About 150 years ago all agricultural discussion revolved around humus and manure. Then came Liebig (1803-1873) with his great discovery of the importance of nitrogen, potash, and phosphate for soil and crops and everybody concentrated upon mineral fertilizers to such an extent that 50 years ago one thought that one could solve the problem of soil fertility with these three mineral components. The result? Our soils have been enriched in NPK but depleted of almost everything else, magnesium, for example, trace elements, manganese, and zinc. Only two trace elements have been considerably increased, namely arsenic and copper.

Now we are experiencing the reaction to the one-sided Liebigism: humus and manure again. There is however a difference: we know more about manure, its fermentation, and how to preserve it better. About 50 to 60 years ago one could actually read literature which stated that manure was harmful. The fact of the lodging of grains was mentioned (reasons: too rich in readily available nitrates or ammonia). Complaints were raised that it was unsanitary because of its odor or the unsightly appearance of a steaming heap from which a brown juice ran off into the countryside. A reminder of this period is the law, still in effect, which requires the manure yard to be placed far away from the milk barn (contamination, infection). I have never quite understood the logic of this law for manure on the pasture seemed to be thought less "dangerous." It is still considered the best fertilizer for cow pastures. Yet every cow, at least, knows that they do not feed on their own droppings nor on the lush grass which grows on them.

All the objections which have been raised against manure, in the past, can be eliminated at once if it is stored in a composted state. On the basis of the fear of manure the general recommendation was made that manure should be plowed under immediately, every day, as soon as it has been removed from the stable. Such a suggestion is a typical idea of laboratory and office farming, i.e. theoretical. In practice, one cannot plow "every" day. The consequence is that the manure is spread every day and lies somewhere exposed to the rain, the sun, and other

similar influences, until the day arrives when it can be plowed or disked under, or until it has somehow disappeared naturally, on grassland, for example.

In all these cases the manure has been leached out, has undergone a quick aerobic fermentation with the burning up of much organic matter and has lost most if not all of its nitrogen through ammonifying and denitrifying bacterial action. It has become acid, its manure and humus building values are greatly reduced, in fact, only the non-volatile minerals remain. I quote from Joseph E. and Ethelyn O. Greaves "Elementary Bacteriology" (W. B. Saunders Company), page 224: "...the microorganisms compete with the higher plants for the limited supply of nitrates in the soil. This is exemplified when straw or fresh manure is plowed under a few days or weeks before a new crop is planted. Under these conditions the straw or manure may have a distinct retarding effect upon the crop..." No wonder our soil chemists of the past doubted the value of manure; in particular, the German soil chemist, sponsored by the Nitrogen Syndicate, claimed and still claims that the nitrogen problem cannot be solved with manure but only with sulfate of ammonia, Chilean and all the other nitrogen fertilizers. It is merely wrong manuring practice which has made manure unpopular or rendered it ineffective. From the sanitary point of view, I do not see that there is much difference between a smelly barnyard and a smelly field. I still remember the time when the manager of our truck garden in Holland came home after work and his wife said: "Oh, get out, you've been handling manure again, you . . . .!" How grateful she was when we introduced biodynamic composting practices. One sniff told her whether he had used treated or untreated manure.

This is the Alpha and Omega of all composting procedures: transform the raw manure into stable humus before you use it and there will be no losses and no ill effects. No matter whether you use Sir Albert Howard's methods, biodynamic layering and covering with earth or others, these are the points which you must watch:

1. Pile your material *directly on earth,* if possible good surface earth with access to earthworms and soil bacteria or on the site of an old heap the bottom inch or so of which still remains. Do not set heaps up on concrete, on stones (the bottom of the heap will stay wet and smelly), or on sod land (in this case sometimes a silage, butyric acid fermentation will be started). A one to two foot deep pit may be advisable, especially in dry and southern climates. The dryer and hotter the climate, the deeper should the pit be. Irrigation can be led right up to the pit. In rainy areas and with wet manure you may not want a pit but a drainage arrangement, made of briars, straw, or rough weeds, piled lengthwise on the bottom, with a few cross pieces in a larger heap and probably a few upright "chimneys."

2. By all means, no matter what material you use nor at what stage of construction your compost or manure heap is, *cover it.* A temporary cover to be used during the building up period, can be made out of straw, weed straw, old hay, or even planks or bags. The final cover should consist of a layer of topsoil (1-2") and/or a thick layer of old straw or hay. These outer layers can be removed with a fork and used over again. In fact, when we set up a heap we always have an earth pile and a cover-material pile ready.

3. *Control humidity and aeration.* The desirable fermentation, described in the article mentioned above, can be obtained and maintained by means of moisture and air control. The moisture should be that of a wet, but not dripping sponge. As a sponge is porous so should the heap be porous. A semi-aerobic condition is most favorable. Nitrogen-fixing and nitrate-forming bacteria can only work if they have access to air. In a completely anaerobic (absence of air) medium only ammonification or denitrification

or even (when very wet) only carbonization takes place. If your heap dries up and is too porous, too loose, then a combustion process will begin. Cellulose-digesting thermophilic bacteria will prevail, all nitrogen is lost, no humus forming or nitrogen-fixing bacteria can or will live for they prefer low temperatures. Below 100° F. is best since humus forming processes are most active between 55° to 80° F. Thermophilic bacteria thrive between 100° and 150° F. The writer has even seen a compost heap on fire, actually bursting into flame. In this case very dry cornstalks were moistened only slightly, quicklime was sprinkled over them, very little earth used, the whole heap was set up too loosely. The result was that the quicklime consumed all the water, heated up and set the dry stalks on fire.

Always remember, when you start a heap, to add enough water so that the material gets really wet. Loose material should be slightly packed; moist, smeary material slightly loosened (use a fork) and interspersed with loose, bulky, chaff, straw or weeds. Too wet a situation can always be corrected by starting the heap on a briar-straw drainage base and, later on, by poking air holes into the heap. A wet, steaming heap can literally be "perforated" from top to bottom at distances of 2 to 3 feet in every direction. This is still simpler and takes less time than turning a heap. However, a small heap (1-5 cubic yard) might better be turned when something goes wrong. After the heap has steamed or dried out sufficiently one can cover the holes again, usually after 2 to 3 weeks.

Too dry a heap needs a lot of water. This watering is best done by splitting the heap slightly in a lengthwise direction on the top center, pushing a hose down about 1/3 of the depth of the heap, and letting the water run until it overflows.

You may ask how can I know when a heap is too hot and dry? In the beginning we used a thermometer and took a spade, pushing it down the side-wall of the heap with a little splitting motion. If a lot of ants, sow bugs, or centipedes were on or just under the surface the heap was too warm and dry. After you have checked several heaps once a month you will gain some practical experience and then can understand the following "thumb" or rather "foot" rule. The shrinkage and elasticity of a heap is a good measure. Too fast shrinking and more than 1/3 of the original height are symptoms of too loose piling and probably lack of moisture. When you step with one foot on the top or side-wall of a heap and it feels as though you were walking on velvet, all is well; if it feels like a springy mattress, it is probably too loose and needs water. When it feels as hard as a beaten path it is too tightly packed, too wet, needs air holes; next time, put a drainage layer on the bottom and use thinner layers of earth. If it is too "springy" the layers of weeds, straw, or other organic matter could have been thinner.

The worst thing that can happen inside a heap is when the layers separate: for example, a "springy" weed layer gets too dry and hot, covered by a sticky wet clay layer plus green juicy garbage. One section rots thermophilically, the other not at all. There is nothing left but to tear such a heap apart and rebuild it. Layers of caked leaves or grass cuttings are also nearly useless. In other words, when you are building up a heap you have to watch the proper mixture and structure. Bulky, weedy material may be shredded. Hay, grass cuttings, and some leaves tend to cake. In order to obtain good results it is just a matter of using good common sense.

Wet manure with sawdust or very little litter needs bottom drainage, air holes and chimneys. Here is the only exception to the rule that fresh material should be covered at once. In this case an exposure of one to two days helps to dry such material out and lighten it a bit. Build such heaps so that you alternate, piling the material on one side today, on the other side tomorrow.

Dry, strawy manure needs treading down. Liquid manure may be used here to advantage. Horse manure, interlayered with thin earth layers, well covered and trodden down somewhat, can ferment without heating up.

Now as to *color*: Any shade from dark to light brown is good. A blackish, greenish, or bluish color, when wet, means that there is not enough air, or that a drainage base is needed. Green to yellow-brown indicates an excess of moisture and not enough air (needs air holes). Grey mold is a sure sign that the material is too dry and hot; pack it down and water.

Smell: The only proper odor is that of earth or woods soil. Any other smell, after the initial period, foul, acrid, putrid, is a warning signal, usually of insufficient aeration or not enough contact with earth layers or cover.

No plants or weeds should grow on a heap. Their roots take away moisture and plant food which is necessary for the microlife. If for some reason (much rain f.i. followed by drought) the cover should cake and be sealed over, it is necessary to loosen it to provide access to the air. Because of this it is advisable to build heaps up in the shelter of trees, shrubs, or even straw mats, during summer and in periods of drought. This all sounds very complicated. In practice, after a little experimenting and observation, you get a kind of finger tip feeling that will never fail you. Always remember that a compost or manure pile is a living being in itself, with a skin, a lung (resp. a breathing system), a digestive system. Instead of blood vessels, the earthworms crawl about. Indeed, if it only had wings and legs to spread itself on the field it would be perfect.

Finally a table of average manure values:

2000 lbs. (1 ton) of manure contain in pounds:

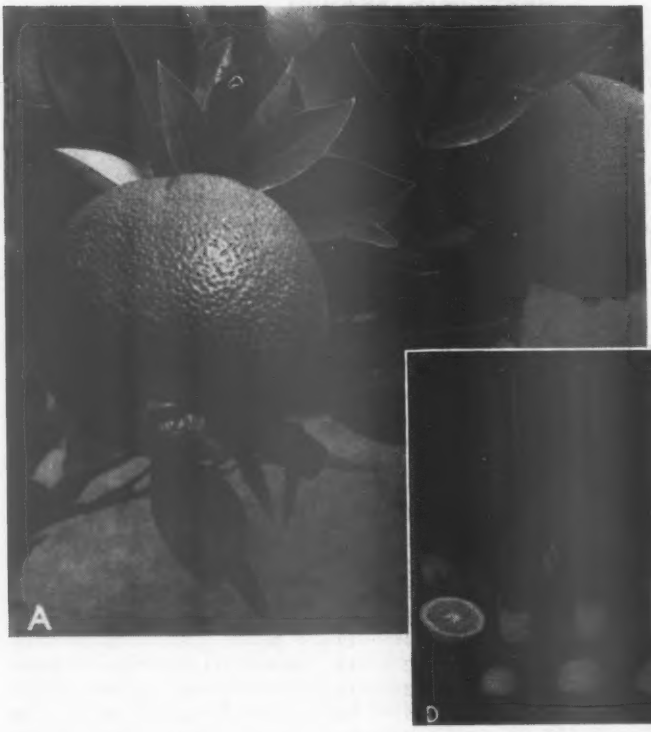
	Water	Organic Matter	Total N	K	P	Ca	Mg	SiO_2
Cow, fresh	1705	440	7	11	6	10	2	19
Horse	1568	358	13	12	6	5	3	39
Sheep	1496	660	19	15	5	17	4	32
Poultry	1232	561	34	19	34	53	16	77
Mixed, fresh	1650	402	10-12	13	4-6	11-21	3-4	21-24
Mixed, rotted	1694	374	12	15	5	15	4	37
Liquid Manure	1 cu. yd.	18	6	12	.2	.7	.9	.4
Pig	1593	551	10	13	4	2	3	24

From this table we can draw some interesting conclusions. One interesting fact is the high nitrogen, potassium, phosphate and calcium content of poultry manure. Whenever there is a deficiency of these minerals, poultry manure used in the compost heap could correct it. Under normal conditions one would need to use much less of the poultry manure for such corrections, than any of the others. There are, of course, many other possible courses which can be charted from such a table, some obvious and others which will not be apparent until one has experimented a bit.

Vest-Pocket Vegetable Guide, 25 cents. **Manual of Organic Materials,** 35 cents. Order from Organic Gardening, Dept. Z-1, Emmaus, Pa.

that

By
HERBERT
CLARENCE
WHITE



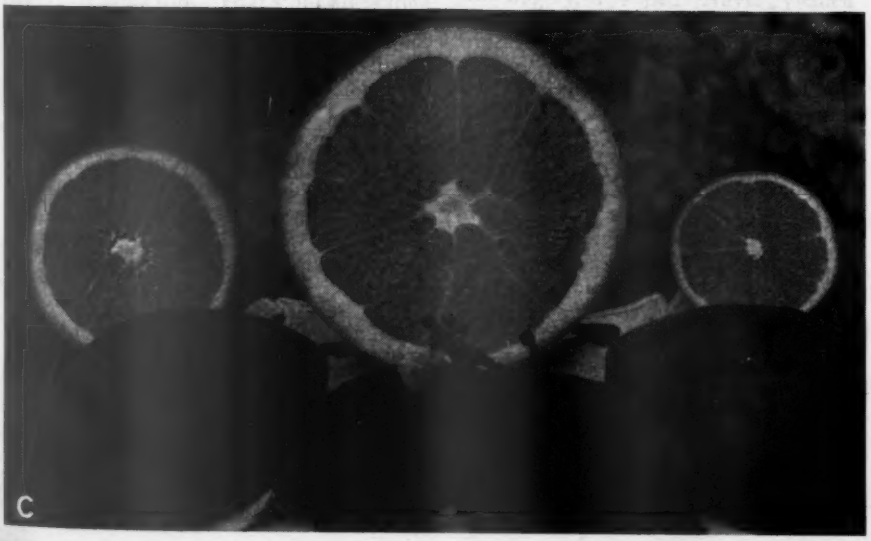
IN the December, 1946 issue of *Organic Gardening* there appeared an article entitled, "Babies Produce Giants." Among the eight pictures shown to substantiate my claims and give visual evidence of my veracity, was one on page 47, portraying a baby Robertson Navel with two huge oranges. In connection with the story, I made the observation that the largest of these two oranges measured a little less than eleven inches in circumference four months prior to harvest time. It may be of interest to some of our *Organic Gardening* fans to learn what actually happened to that "big orange."

Before I start, however, I pause long enough to "swear" to tell the truth, the whole truth, and nothing but the truth. Otherwise you will be tempted to disbelieve me, and Mr. Rodale might throw out my "story" as a myth and a fairytale.

In my previous article I mentioned the fact that Gardena—situated only five miles from the Pacific Ocean, and ofttimes foggy and damp in the winter—is not what we might call good orange country. The warmer, dryer inland valleys prove far more suitable and productive for citrus culture. The nearest orange grove is probably ten miles or more from our spot. It is recognized also that oranges and other citrus fruits do their best in sandy loam. Our Gardena soil is heavy adobe, with yellow clay at a depth of only 12 or 15 inches.

So, all the odds were stacked up against us in the matter of producing quality citrus fruit in our particular location. The only favorable factors on *my* side were a large earthworm colony working

baby orange HOW IT GREW!



in the soil under my baby tree (planted August, 1945), a one-inch layer of compost humus, plus a leaf-and-rock mulch. (See September, 1946 issue of this magazine). Considering the above adverse factors, I am inclined to give a great deal of credit for what happened to these organic gardening procedures—this thing that we call "biological soil building."

You will agree with me that an orange eleven inches around the middle is a big orange. That was in August, when the orange was still green. Much to our delight, the big fellow kept on growing—all through September, October, and November; until it finally attained the fantastic proportions of a large-size grapefruit. To be exact, it measured just 14 inches around! Almost 4¼ inches in diameter!

In December I showed Mr. Robertson (the originator of the Robertson Navel) a kodachrome transparency of this big orange. He looked at it, agreed that it was big, and remarked that it was probably a "freak" and would prove no good as edible fruit. In other words, in spite of its size, it was a failure. Other bigtime, experienced citrus growers who heard about this monstrosity, also came to see my baby tree with its giant oranges.

All the "critics" gave very frank and extremely pessimistic predictions regarding the *quality* of the fruit. "Sure it's BIG," they would say, "but it won't have any juice. It will be thick-skinned and pithy." Me? Did I punch them in the nose? No, I just listened, kept my mouth shut, crossed my fingers, and prayed for JUICE!

December, 1946 gave us Southern California folk the snappiest cold spell in twenty years. Nearly everything in my little garden was laid low. Canna, calla lilies, passion vines, poinsettia, bougainvillea, hibiscus—all were mowed down. The destruction was as complete and devastating as any forest fire could ever be.

During all this frigid weather, so unlike Southern California, my big oranges hung exposed to the frost and the ice. No attempt was made to protect them in any way. Limequats (without rock mulching) froze stiff. Six inches of new growth were nipped off my Armstrong seedless lemon; but nothing happened to the baby orange tree. Perhaps the rock mulches, gathering heat from Southern California's sun during the day, gave off some of the accumulated heat when it was needed most.

In January I visited Mr. Robertson in his Redlands home, surrounded by a magnificent orange grove. I was delighted with what I saw there. Robertson follows Frank Hinckley's non-cultivation methods in citrus culture. But he goes one step farther than Hinckley in that he will not tolerate the oil sprays used by the pioneer in the "non-cultivation" method, to keep down weed growth. He still follows Hinckley's *original* plan of controlling weeds with a hoe, a rake, and a shovel.

Robertson proudly showed me his fruit-laden trees. If anything, they were finer than what I had seen at the Hinckley groves. The fruit was a deeper color, and the hi-gloss leaves were a richer, deeper green. Across the way, not over forty feet from the Robertson grove was another orchard belonging to a neighbor. Here regular, so-called scientific methods are used in caring for the trees. The fruit was scanty, below average size, and the color was terrible—yellow and anemic-looking. The young leaves were about the color of a canary.

What a contrast between oranges grown the organic way, and those grown according to "the book!" And let me tell you, there was just about as much "difference" in the flavor of the fruit. We tried both right there on the spot. I asked Robertson for a sample of each to take home with me. He graciously acceded to my request. I had an idea back in my head of working out a little Navel orange exhibit—a picture in "contrasts" for the benefit of all who should attend my illustrated lectures on "Soil and Health."

I also had a sneaking idea that Mr.

Rodale might use a "story" with pictures in some future issue of my favorite magazine, showing what miracles organiculture will perform, if these fundamental principles of biological soil-building are put to work in your garden or orchard.

Next day I picked the big orange from my own little tree. It hurt me to do it, as this monstrosity had become a part of the landscape. But I couldn't wait any longer, so off it came! Its stem was as big around as a lead pencil. And then the fun began. I hauled out one of our Chinese teapoys, borrowed one of my wife's Chinese doilies, with its beautiful cutwork, and lined up my fruit. (See Plate B.) And what an exhibit it made! I had brought along some of the anemic, yellow leaves, as well as a sprig or two from Robertson's fine grove. I also plucked several giant leaves from my baby tree. Some of these measured three inches across and six inches long. I wish you could see the kodachromes of this "shot." Notice how my 4¼-inch organically-grown Navel towers majestically above its fellows! You can almost detect the deeper richer tone in the color of the big fellow.

When a week or so later, I showed the kodachromes to the boys at the Spanish American Institute, one little fellow cried out, "That's not an orange —that's a pun'kin!" And all sixty boys hollered approval.

For about six weeks I carried these oranges around in my hand bag as an exhibit. Then I noticed that the fruit was beginning to shrink and become soft from overhandling and age. So on Lincoln's birthday I decided to cut them open and measure the amount of juice. Again I hauled out the teapoy and doily. Again I set up my cameras. My mother, who was visiting us that day joined in the fun, as we sliced the 3-inch Robertson Navel from Redlands, the giant 4¼-inch Navel from my own tree, and the tiny 2-inch Navel from the cultivated and chemically fertilized grove. (See Plate C.) What a study in contrasts it made.

Our readers can well imagine the excitement in the Herbert White Household as we cut into the big fellow—our pride and joy! It was our prayers against the dictum of the experts. They said there would be no juice, "the big fellow would be no good." When we opened it up, all questions vanished. We could all see there WAS *plenty of juice;* but how much, none could tell. The next step in our experiment was to squeeze out the juice from each of these four oranges. A separate glass was used for each orange. We placed the glasses in the refrigerator and waited.

Next morning I ran over to the Gardena High School, barged into a chemistry class, and hauled off four large graduated cylinders. What I did with those cylinders need not be told in words—just take a look at Plate D. It answers in capital letters our question, "Was there any juice?" I just couldn't believe it, but graduated cylinders don't lie, and neither does my camera lens. In ounces, it stacked up something like this:

The 2-inch Navel yielded 1 1/16 ounces of juice.

The 2 1/2-inch Navel yielded 1 1/8 ounces of juice.

The 3-inch Navel yielded 2 1/8 ounces of juice.

My 4 1/4-inch Navel yielded 7 1/2 ounces of juice.

In other words, believe it or not, my organically-grown, leaf-and-rock mulched Navel yielded just *seven times* as much juice as the smallest orange; over six times as much as the 2½-inch Navel, and over three times as much as the 3-inch Robertson Navel from Redlands, grown by Robertson himself! Did I stick my chest out! Did I shout for joy! But that is not all.

I determined to put this intangible thing called "quality" to the "acid test." So I placed the juice from all these oranges in ordinary drinking glasses and set them on the drainboard of our kitchen sink. Here they remained at room temperature for two more

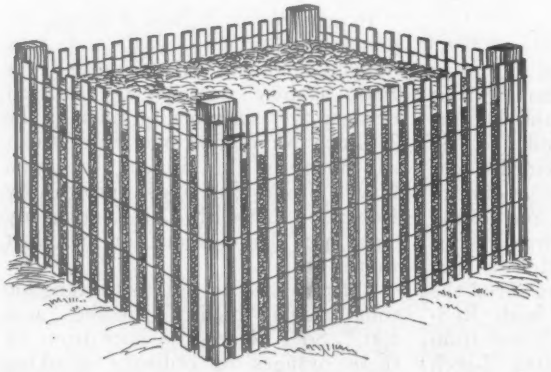
days. Anna thought I was crazy (but that doesn't hurt any more when organic gardening experiments are concerned). I was determined to "give it the works," and prove that the "big fellows" in the citrus industry aren't *always* infallible.

Then, after forty-eight hours, we tested the *quality* of the juice. We didn't do anything "scientific"—just drank the juice and evaluated its flavor and palatability. For after all, it's the "taste appeal" that really counts. We first tried the juice from the little 2-inch fellow. There wasn't much of it; but what there was had completely changed in character. It was bitter and unpalatable. We spit it out. We then tried the 2½-inch Navel, with exactly the same result. Next came the 3-inch Robertson. It too had deteriorated noticeably; but we *could* drink it. Then last, but not least, came the grand climax in our experiment. We drank the juice—a whole glassful—from the big Navel from our own tiny tree. And wonder of wonders! The juice had *retained* its quality! There was no bitter, tangy taste—just fresh flavor-perfect juice. From the standpoint of flavor and quality, it could have been squeezed out five minutes before!

I'm not given to extravagant statements, but friends, I'm almost *sold* on this idea of *organic gardening*. If you don't think so, ask Mr. Rodale—or perhaps, my wife.

A READER SUGGESTS

A NEW USE FOR A SNOW FENCE



A snow fence or any other kind of fencing and four posts are all that are needed to construct an effective enclosure for a compost heap. The enclosure can be made as large as may be necessary but enough posts to keep the fence upright will have to be used.

The perfect health and vigor of an organically grown vine.

Cucumber Culture With Compost

By L. C. LEMMON

EACH growing season should add some constructive lesson to the gardener's experience. This is especially so if the gardener is possessed of the organic outlook. He then knows that one season's growth is, in a great measure, dependent upon the decay of preceding seasons.

In my own garden the most outstanding lesson of this past season came much as a surprise. It had to do with a hill of cucumbers which proved eminently successful. This success was in no way due to any forethought or planning on my part, but developed quite by accident as the result of a set of circumstances with which I was familiar.

It has been our habit to return kitchen wastes to the soil day by day rather than give them to the county garbage collection. This we have done by various methods. To handle this disposal in the fall of 1946, I dug a hole near my compost heap. This hole was four feet square and three feet deep, and the earth removed was put in a pile close by.

After I had completed my digging I noticed a large pile of raspberry canes which I had pruned from my bushes during the summer and was

reluctant to burn. The thought occurred to me that here was the opportunity to incorporate such woody stuff into the soil as it would be deep enough not to hinder cultivation.

I reasoned that if this woody material were chopped into short lengths, it would pack much more closely but still be absorbent enough to take up much of the watery waste during freezing weather. I threw the canes into the hole and went to work on them with a mattock. After a half hour's chopping I had the hole half filled with nicely broken canes and ready to receive kitchen refuse.

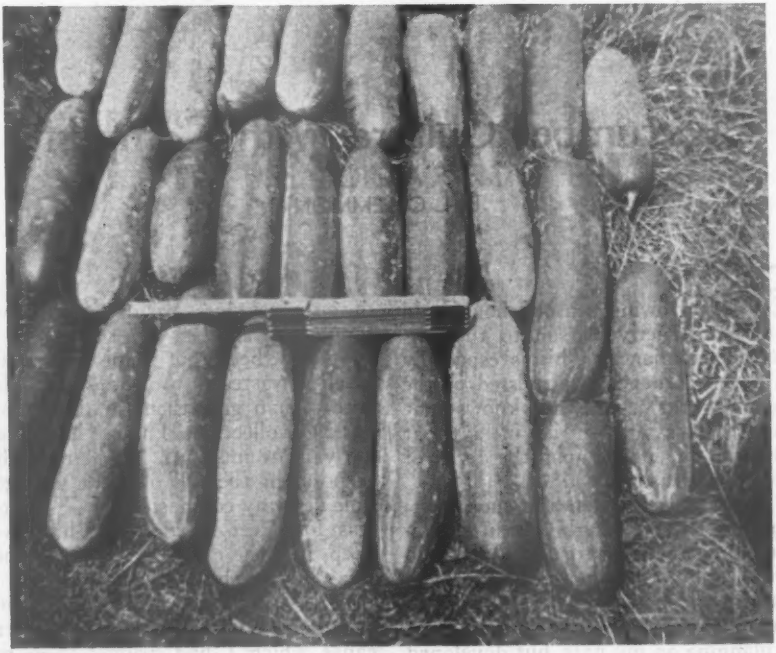
A large heap of autumn leaves was kept close at hand to cover the daily deposit and to prevent any possible nuisance or unsightliness. From time to time when the weather permitted, a shovelful of earth was scattered over the contents of the hole.

As we had been raising domesticated earthworms for some time in our basement, I decided to add a box of them and their castings to the contents of the hole. This was done before freezing weather set in and to make sure the worms would stay near the surface I added a bushel of horse manure at the same time.

By spring much of the earth which I had excavated had been returned to the hole along with kitchen waste and leaves. At this time we decided to close the hole and add our refuse to the compost heap which, with its millions of worms, was able to transform this waste to good soil in a week or two, in warm weather.

Having no further need of our little hole, we drew the remaining local earth into it, and added a few bushels of woods earth and levelled it off with the rest of the garden.

From then on the kitchen refuse



An average picking of organically grown prize beauties.

was added to the compost heap and the hole was forgotten in the rush of gardening activities until it remained the only unplanted area in the garden. This little square area quite naturally suggested cucumbers, so a small packet of hybrid seed was put into the ground and fifteen healthy seedlings came up. They were all so vigorous that we never had the heart to thin them.

Before very long my cucumbers had grown so vigorously I had to do something to protect my other crops. I drove tomato stakes into the ground and led some of the vines into the air; the remainder I directed towards my compost heap. These latter were permitted to range all over as much of the heap as they could cover. As my heap had a base measuring 12' x 20', the reader can get some conception of the extent of these vines when I say that they covered half of this area with a tent of green. I have never before seen so few vines cover so much territory in such a short time.

Seeing so much vine develop we were a bit apprehensive as to whether there would be any fruit. As it turned out, we needn't have been. Before the season was over this magnificent hill had produced 178 excellent cucumbers, 144 of which weighed one pound or more.

During this period of vigorous growth not a blemish of any kind was to be found on leaf or vine, and the phenominal thing about all this was the fact that every day for a period of at least four weeks we could find striped and twelve spotted cucumber beetles on the raspberries and tomatoes just a few feet away. I'm confident they were not eating the leaves of either of these plants, nor were they disturbing the cucumber. Perhaps they wanted to be near for any sign of weakness. This would seem to bear out the theory of Mr. Rodale and others that our so-called garden pests may not care for the taste of a healthy plant, preferring rather to feed upon one which is undernourished or otherwise unfit for survival.

Nothing was done to side-dress or fertilize these vines as is recommended by most authorities. In spite of this negligence they held their initial vigor until 140 large crisp fruit had been borne.

The first indication that the vines were not so strong as formerly, was the evident diminishing size of the fruit. Having reached the zenith of their powers they had begun the descent. Then we began to see the beetles on the vines. Leaves would be eaten and withered and the good dark green gave way here and there to pale green and then to yellow.

In spite of these difficulties the hill continued its production, and before we decided to pull up the vines they had produced twenty more pounds of nice cucumbers.

This experience has taught me several important lessons: 1. Organically grown plants can be so healthy that garden pests will not attack them during their most productive period; 2. Lack of vigor precedes depredations from disease and insects; 3. The health of the soil is the first and most fundamental interest of the farmer or gardener.

Kodachrome Slide Library

We invite our readers to help us build a library of colored slides of gardens, garden and farm activities, and organically grown flowers, vegetables, and fruits. We will pay $1.00 for each 35 mm. slide and proportionately more for the regular lantern slide size for all slides accepted for the library.

All-America Selections of New Flowers and Vegetables for 1948

By DR. WILLIAM H. EYSTER

EACH year the new flowers and vegetables are grown in trial gardens in various climatic sections of the United States and Canada under the supervision of the All-America Committee. This committee, composed of capable persons, inspects these gardens at frequent intervals during the growing season and then recommends for awards those plants which, in their composite opinion, are most promising for the average gardener. The plants thus selected are known as the All-America Selections. The All-America Selections for 1948 include three flowers and five vegetables with special mention to three additional vegetables.

The most outstanding new flower is *Radiance* cosmos, a hybrid between a former All-America selection, Sensation cosmos, and a variety from India. This hybrid was made by the late Elizabeth Bodger and should be regarded as a beautiful and lasting memorial to her. The new Radiance cosmos is a bi-color in that the outer part of each ray floret is rosy pink while the basal part is deep crimson. This color pattern is further enhanced by the golden yellow disk florets in the center of the head. The plants grow to a height of five or more feet and bear terminal flower heads on long, wiry stems. The plants are easily grown from seed and are recommended for tall borders, backgrounds, and cut-flowers as they are long-lasting and especially colorful under artificial light. This flower was awarded the silver medal.

The new petunia, *Pink Sensation,* was awarded the bronze medal. Although the plant grows to a height of two feet or more, it maintains an erect, rounded habit and bears a profusion of rosy pink flowers. The erect habit is maintained to the end of the growing period so that Pink Sensation petunias may be used effectively for tall edging, border, or even an annual hedge. In the deep South the plants continue to grow and bloom in the winter months.

The *Red Head* marigold was also awarded a bronze medal and is regarded the reddest marigold that has as yet been introduced to the gardener. The dwarf, compact plants are uniformly 12 to 15 inches tall and bear two-inch heads of flowers on strong, stiff stems. The flowers which open a deep mahogany red soon fade to a bronzy gold so that single plants have

various shades of harmonizing colors. The plants can be grown satisfactorily in almost any soil but they prefer a sunny location.

The All-America Committee must have been especially pleased with the snapbeans that were included in the All-America Trials, as they awarded the bronze medal to three varieties and gave special mention to a fourth. The *Peerless* bush lima bean won an honorable mention for its heavy production of fine-quality beans in pods near the base for easy picking. A sectional award was given to *Excel* onion, a yellow Bermuda type which is recommended only for the lower South.

Pure Gold wax snapbean bears a profusion of clean, golden, long, slender, round, brittle, stringless pods which have a delicious flavor whether eaten fresh from the plants or after they have been in cans. They are ready for picking in about 58 days from the time of planting.

The *Ranger* is a round-podded, green snapbean. The plants are vigorous and have a spreading bush habit. It is a heavy yielder and the stringless pods have an excellent flavor. The mature pods bear white seeds which may be dried for winter use.

The *Supergreen* is a stringless, green-podded snapbean which promises a new high quality bean for the table. It rates high in all the desired qualities and is an unusually high yielder.

Two new peas, *Victory Freezer* and *Freezonia,* were given awards by the committee. Both of these peas have been bred for yield, disease resistance, flavor, and deep-freezing qualities. The plants are from 28 to 30 inches tall and should be given supports for best results. The pods are ready for picking in about 64 days from time of planting.

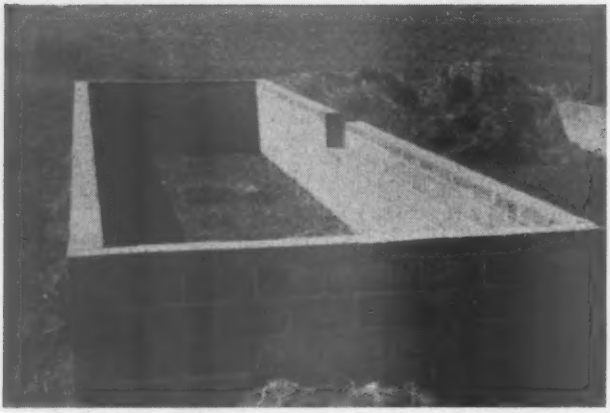
Seeds of these new flowers and vegetables are available in limited supply from most of the leading seedsmen.

Earthworm—
World's Most Valuable Animal

The pelt of a silver fox may sell for hundreds of dollars. The legs of a race horse may be insured for a quarter million. Yet neither is the world's most valuable animal. The most valuable animal is that humble burrower in the soil, the earthworm.

Its coming is a sign of spring. Beginning again is its invaluable work of plowing, pulverizing, fertilizing, and draining the soil. As many as 50,000 earthworms may plow through the soil of a single acre. During the year, they may bring as much as eighteen tons of new earth to the surface.

This labor is achieved with curious but effective equipment. Instead of legs, the earthworm employs upwards of 1000 bristles. Each body segment except the first and last, is equipped with eight of these bristle-hooks. They are used to grip the soil on all sides.



1. Cement blocks make an excellent enclosure for the farm compost pit. It is desirable to dig it into the ground from 18 to 24 inches, as this enables the compost heap to draw moisture and heat from the soil. Through the earth floor earthworms and other soil organisms can enter the heap and take a part in the composting processes. The enclosure reduces water loss by evaporation to a minimum.

FILLING THE FARM C

2. The first step in filling a farm compost pit consists in putting down a six-inch thick layer of plant material sometimes referred to as "green material." The more kinds of plant materials included, the better: alfalfa hay, weeds, leaves, garden wastes, spoiled hay, soybean tops, straw, or plants grown specifically for composting. Freshly cut plant material should be cured like hay before using it in the compost heap.

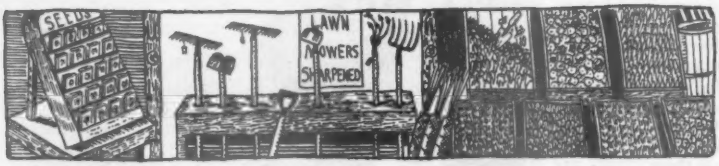
3. On top of the layer of plant material is put a layer of fresh manure two inches thick (but a little less if poultry manure is used). The manure contains the animal residues which are rich in the microorganisms which play an important part in breaking down the plant materials and converting them into compost. Compost is more than decomposed organic matter; it represents highly complex organic compounds which are absorbed directly by the higher plants.

4. Pulverized raw limestone is added to each layer of the compost heap to neutralize the acids which are formed as products of decomposition. The bacteria which play an important role in the early stages of composting prefer a neutral or slightly alkaline medium for greatest activity. Burned lime and hydrated lime are sometimes used in the compost heap and on the land, but these forms are rather caustic.

COMPOST PIT

5. Since making compost involves many biological processes, moisture is absolutely essential. Water should be added to each layer in the form of a spray through the nozzle of a hose or sprinkling can. Water should be added until the material has the water content of a squeezed sponge. To make sure that the heap has enough moisture, water should be added to the finished heap as soon as it is completed and again the following morning.

6. The first layer of the compost heap is completed by the addition of a very thin layer of good ground not more than one-eighth of an inch thick. The soil is very important as it acts as a base to absorb nitrogen and other volatile decomposition products. The layering just described is repeated in every detail until the heap is 5 feet high. When the heap is finished, open holes from top to bottom of the heap at intervals of 2 feet to serve as ventilators. For rapid decomposition there must be oxygen from air.



Garden Calendar—February

February is still a winter month but plans for the garden should be completed if this has not already been done. Check over the calendar for January to make sure that the garden activities mentioned there have been carried out. Include in your plans a garden diary. Your diary notes will prove of great value in subsequent years. Notes on the height of plant, color of foliage, time of flowering, form and color of the flowers, and the duration of the flowering period will be of especial importance in getting a good succession of plantings in your garden.

THE NORTH

Flower Garden:—The larger seeded annuals should be started from six to eight weeks before it is time to set them outdoors.

Sweet peas and other hardy annuals can be planted outdoors this month if weather conditions permit. Many gardeners regard Washington's birthday the optimum time to plant sweet peas. Plant the seeds about one inch apart and cover with about one inch of soil.

Plants which usually seed themselves in the garden as bachelor button, godetia, candytuft may be seeded outdoors this month. The seeds should be sown where the plants are to grow in the garden.

Virginia stocks, sweet alyssum, and dwarf godetia are especially adapted for seeding the bulb beds. These fast-growing plants will screen the dying leaves of the bulbous plants after they are finished blooming.

Inspect the dahlia roots, gladiolus corms, and tender bulbs to make sure that they are still in good condition.

Hydrangeas, roses, and late-summer-blooming shrubs should be pruned in February.

If you have a wild flower garden you will be delighted to see the earliest flowers making their appearance in February. Skunk's cabbage will actually be in full bloom before the end of the month.

Trees and Shrubs:—This is a good month to transplant trees, shrubs, roses, and evergreens.

This is the month that shrubs with beautiful fruits which serve as foods for the birds prove their greatest value and satisfaction. Plan for more of these shrubs for next year. Enter this need in your garden diary.

THE WEST COAST

Flower Garden:—Cut back mignonette, alyssum, ageratum, and petunia so that new growth may be formed and flowers produced before your new plants grown from seed come into bloom.

Sow outdoors sweet peas just as soon as weather conditions and soil permit.

Tuberous begonias may be started in the dark by laying them out in boards and sprinkling them with water every day or two. When sprouted, put them in wet peat or sphagnum moss until the sprouts are several inches long when they should be potted in soil rich in compost.

Reset your chrysanthemums for fall blooms.

Trees and Shrubs:—Plant trees, shrubs, and roses.

THE SOUTH

Flower Garden:—Sow the seeds of half-hardy annuals in seed pans or seed flats. Use plenty of compost for quick germination and strong seedlings.

Inspect gladiolus corms, dahlia roots, and bulbs to make sure that they are keeping safely until time for planting them out.

Fertilize the spring-flowering bulbs. Interplant tulips with half-hardy annuals as soon as danger of frost is past.

Plant seeds of the hardy annuals in the middle South, and tender annuals in Florida and along the Gulf Coast.

Set perennials out just as soon as the season will permit.

The following annuals may be set out in February: ageratum, alyssum, anchusa, snapdragon, candytuft, carnation, cornflower, Chinese forget-me-not, daisy, pinks, gerbera, larkspur, lupine, mallow, pansy, petunia, annual phlox, stocks, sweet William, viola, and others that can stand cool weather.

The first gladiolus corms may be set out the first week in February in south Louisiana and at two week intervals thereafter for continuous blooms through the summer.

Trees and Shrubs:—Roses should be pruned after the last killing frost. This also is the time to plant roses, abelias, pyracanthas, and privet.

This is a good time to make cuttings of trees and shrubs.

Prune late-summer blooming shrubs and evergreens, but do not prune spring-blooming shrubs until immediately after they have finished blooming.

This also is a good time to plant woody vines of which the South has many. Do not miss jasmine and cross vine.

Join Our Garden Seminar

We invite our readers to join our garden seminar by writing a short article on the topic, "How I Plan My Flower Garden." The best article will be selected for publication in the *Organic Gardening Magazine*.

Prof. J. Costantin, noted French botanist, who advanced the theory that many plant diseases could be cured by growing the plants in mountain humus at high altitudes.

M. Joseph Bouget, botanist of a station high in the Pyrenees Mts. who found wild potatoes with their roots infected with mycorrhiza in a vineyard, which suggested to him the possibility of raising potatoes from seed in a similar soil and location to free them from degeneration diseases.

Mycorrhiza and Altitude as a Preventative for Plant Diseases

By B. F. LUTMAN
Professor Emeritus, University of Vermont

SOME people these days sit around and brood over the destruction of a large part of humanity by atomic bombs. But other disasters might strike the modern world that would be almost as bad. They have grown so accustomed to life as it is, that they cannot imagine a world where some of their staple foods, together with the security that it gives them, might be wiped out suddenly, or in a few seasons.

People are absolutely dependent on the plants for their food in the final analysis. If two or three of their most important plant foods should suddenly collapse, life certainly would be different and more difficult, especially with the increasing pressure by the world's hungry millions on its lessened and dwindling food supply.

Sugar cane and potatoes are next to wheat in importance as food plants. These two plants are alike in that they are usually grown from cuttings and are both so badly affected by diseases,

especially those of the degeneration types, that crops have diminished and the cultivated plants themselves are even threatened at times with extinction.

Sugar cane stalks look very much like those of corn. Cuttings, a foot or two long, always with at least two nodes (swellings on the stalks from which the leaves come), are planted in rows like corn. In the last twenty-five years, sugar cane throughout the world has been threatened with extinction from a number of degeneration diseases.

Potatoes are usually grown from cuttings of tubers, which are really underground stems. The yield of the older varieties has steadily declined in the quarter of a century just past, due to leafroll and mosaic, until the harvest per acre has dropped to about a half of that before these degeneration diseases became so prevalent. Of course the average yield per acre of potatoes in the United States has markedly increased during this time; but this increase is the result of the elimination of the poorer fields and regions, and to the introduction of newer varieties that are not so badly affected as yet by these degeneration diseases.

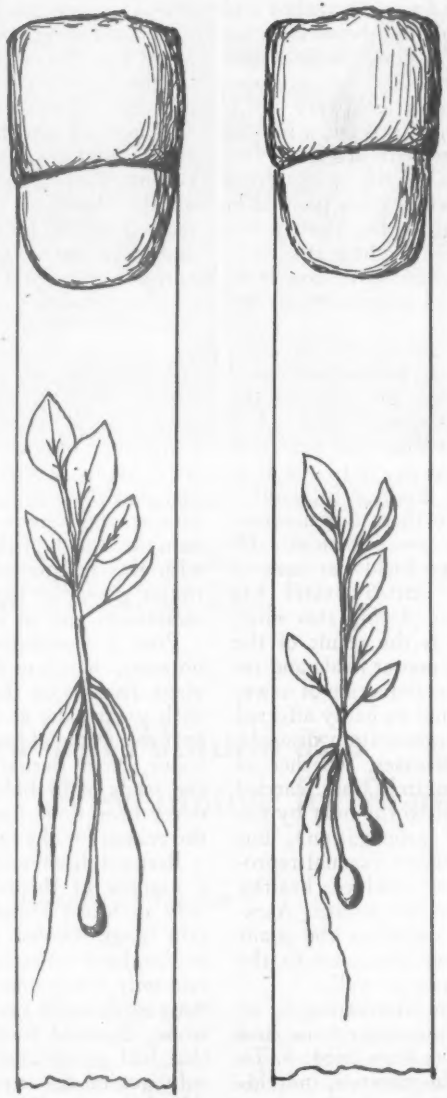
Degeneration diseases, whether in sugar cane or potatoes, are carried over from one year to the next by the cuttings (asexual propagation), but true seeds from flowers (sexual reproduction) seem to produce healthy plants especially in the potato. Asexual reproduction stabilizes the plant characters but does the same to the degeneration diseases as well.

Two methods for eliminating, or at least reducing, these sugar cane and potato diseases have been tried: 1. To choose from the old varieties, individual plants that seem to be free from diseases; propagate them, removing all individuals that show any disease symptoms; to get a new disease-free strain. 2. To select individuals or varieties that are resistant to disease; propagate them by crossing the flowers of resistant plants to get entirely new varieties. These new varieties from seed give a new, healthy start.

Sugar cane was in a desperate condition all over the world about 25 years ago. No individual plants of any of the cultivated varieties were disease-free. This prevented the use of the first of the methods described. But, a wild sugar cane hybrid and its parent plants found growing high up on the slopes of a volcano in Java, seemed to be free from all diseases and were shown to be disease-resistant. They were used to breed new, resistant varieties and from them, the sugar cane industry all over the world was given a new lease on life. Readers of Mrs. Keyes' novel "The River Road" will recall the sad condition of sugar cane planters in Louisiana when their crops became so poor that they were hardly worth harvesting. Normal, healthy sugar cane roots have a mycorrhizal fungus which seems to insure the health of the plants; infection with this fungus being higher on varieties grown at high altitudes in the mountains and in soil rich in humus.

Prof. J. Costantin, a noted French botanist, has based a new cure for plant diseases on the favorable results with sugar cane at high altitudes and on the success of another French professor, Noel Bernard, in germinating the seeds of orchids, a feat that had never been done until he pointed out the reason for the failures.

Bernard discovered that the seeds of a number of the orchids germinated only in forest humus containing certain fungi. Orchid seeds, microscopic in size, have no stored food, they contain only the young plants. On examining seeds under the compound microscope, Bernard found that all seeds that had germinated were infected by a fungus of the mycorrhizal type inside their roots. The fungus helped the small orchid plant by producing sugar to feed it. Unless the young orchid plants inside the seeds have sugar, they never get very far; they starve to death. A fungus is not necessary if the seeds are placed in a nutrient solution to which five per cent of glucose (grape sugar) has been added.



Test-tube baby potato plants grown from disinfected seeds on paper moistened with a nutrient solution (Knop's) containing inorganic salts and 5 per cent glucose (grape-sugar). The plants at once develop small tubers of the size of a grain of wheat to that of a pea. These tubers may then be transplanted to soil rich in humus where they will grow into full-sized potato plants. Growing them in a test-tube insures that there is absolutely no infection with degeneration diseases.

France had been almost reduced to famine several times in the century before 1775, owing to the failure of the grain crops. Parmentier, a French pharmacist who had served with the French army in Germany, was much impressed with the high yields of the potato in that country and on his return home, started a propaganda campaign to spread potato growing in France. He was successful and during the years, 1785-1789, the potato acreage in France swelled impressively. Parmentier was backed by the king and government since the potato seemed to be the best hope for a sure, cheap, and abundant food in years when grain crops failed.

Today, that hope seems to have faded. Potato yields are steadily diminishing and the plant itself is threatened with extinction from degeneration diseases. No chemical treatment will cure them; the diseases are in the plant itself, and they are getting worse every year. A new variety of potatoes is good only for a few years and then must be replaced by a more recent variety that has originated from seed produced from flowers and not from a selection of the best tubers of an old variety. Potatoes produce seed in small balls like tomatoes. Today, they are unusual, being restricted to the newer varieties, grown in cool locations. The absence of seed balls in the potato seems to be associated with the degeneration diseases.

The only known method of freeing either sugar cane or potatoes from degeneration diseases is to start plants from seeds. This point is to be emphasized since it is the basis of all successful attempts to give plants an entirely new, clean, vigorous start in life. The vigor of the plants is highly increased by hybridization and then the young plants should be kept free from infections by isolating them, and excluding all insects that might carry degeneration diseases from older plants.

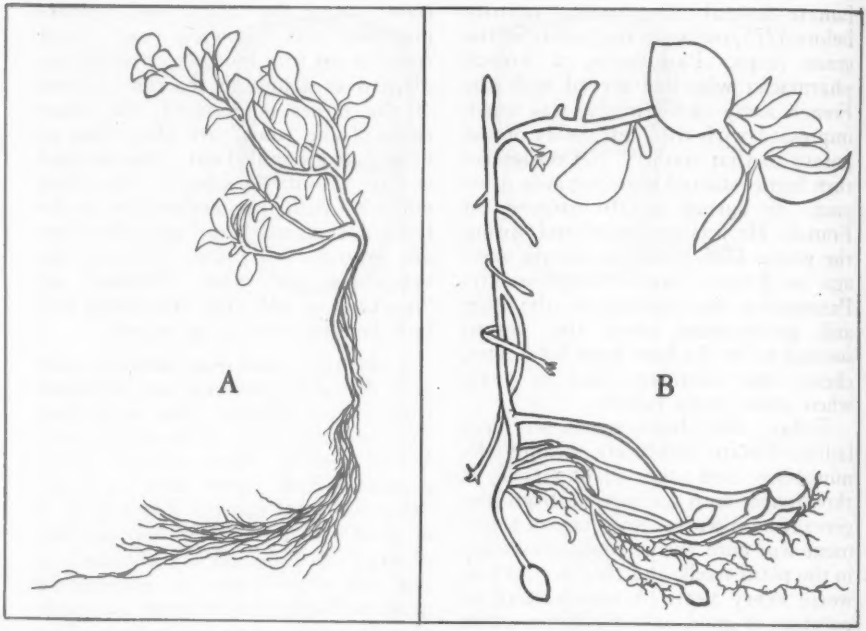
American scientists have tried to improve potatoes in two ways:

1. By carefully selecting plants that seem to be free from all disease symptoms, saving the tubers, and replanting them the following year. Each tuber is cut into four pieces which are planted as a unit in the row. If one of the pieces is diseased, the other three of the "unit" are likely also to be and all are pulled out. This method is called "tuber-uniting." The chief difficulty with this method lies in the lack of certainty that any selections are entirely free from disease; the symptoms are often "hidden" or "masked" so well that the plants will look healthy even to an expert.

2. In this American method, new and desirable varieties are obtained from flower crosses. The seed from these crosses is that of an entirely new hybrid variety. When planted it will germinate into plants which will develop full-sized tubers. The tubers, if of good quality, may be cut and replanted until enough are obtained to put out the variety to commercial growers. No special attempts are made to isolate the young plants from older varieties.

French scientists have offered solutions to these degeneration problems in potatoes along similar principles but quite different in some details. Of course, the problem in France is much more acute than it is in America; the harvest has been cut to about two-thirds that of 25 years ago, and the potato in France is one of the leading crops, not only for food, but also for alcohol, so essential to many chemical industries, and as a partial substitute for gasoline. They recognize the fact that the only real way to free the potato plant of degeneration diseases is through seeds obtained from resistant parents. French botanists, working in collaboration with the famous Pasteur Institute in Paris for twenty years have two methods:

1. M. Joseph Bouget, botanist of a station high in the Pyrenees Mts., directed the work of the first method. Potato seed was sown in soil rich in forest humus at an altitude of 5,000 to 6,000 feet above sea level. The



Young potato plants grown from seed. A. A plant grown in soil with no humus; the roots are fine and thread-like. B. A plant grown in forest humus, rich in mycorrhiza with large stem and leaves and numerous small tubers.

young plants were protected by wire screens from all insects that might carry diseases. In the forest humus the potato roots became infected with mycorrhizal fungi, swelled up, and shortened. Many small tubers were produced. These healthy, vigorous plants were kept isolated in small plots in the mountains until sufficient tubers had grown to release them to commercial growers of fields at lower elevations. Potato hills yielded 2¼ to 8 pounds, or at the rate of 350 to 1,200 bushels per acre, as compared to the average French yields of 175 to 250 bushels. As a consequence, potato seed from this source was particularly liked because of its freedom from disease and its high yields.

These yields may seem large to American potato growers but comparable ones have often been described from small garden plots. American yields of a pound to a pound and a half per hill are average. The writer used to compute 10,000 plants per acre, planted in three foot rows, and 15 inches apart in the row. This arrangement yields a harvest of 160-240 bushels per acre, about the same as the French average.

2. The second method for obtaining potato seed free from degeneration diseases was largely developed by Dr. Joseph Magrou of the Pasteur Institute in cooperation with Prof. Costantin. Potato plants were grown from disinfected seed in large test-tubes. These test-tube, baby potatoes were placed on strips of absorbent paper and a solution (Knop's) of inorganic salts in which was dissolved 5 per cent glucose (grape sugar). The tubes were exposed to diffuse northern light, in

the Pyrenees Mts. at a high altitude. These precautions were attempts to duplicate the original habitat of the potato in the high, cool, shady but tropical valleys of the Andes Mountains in Peru and Chili.

These small plants, thanks to the sugar, formed small tubers from the size of a grain of wheat to that of a pea. Transferred to soil composed mostly of humus, these small tubers grew into plants which were protected by wire screens to keep off sucking insects that might carry virus diseases. These full-sized plants yielded tubers, clean, healthy, and free from all degeneration diseases. Such tubers were increased by cutting in the usual manner and planted in small plots in the Pyrenees Mts. isolated from all other potatoes.

Objections might be raised by potato breeders and growers. Too many years would be required to obtain seed in sufficient quantities to make it a commercial success, and that the tubers grown from seed would lack uniformity in shape and color.

The answers to these criticisms would be that the tuber-unit method, used so extensively in America, required at least five years and the results, even then, would never be as certain as those from seed, raising the plants under wire screens, and isolating them from all other potatoes when they were transplanted into unprotected plots. As for variability, tubers grown from seed were claimed to be quite uniform in shape and quality. The potato plant has much more stability of characteristics than it is generally credited with, and the shape and color of the tubers obtained by these methods were claimed to be quite satisfactory for commercial purposes.

These attempts made in France to control degeneration diseases by mycorrhiza and high altitude are worth the attention of all plant breeders and plant pathologists. The technic may seem to be troublesome and to require expert, trained help but it may represent the only certain way of saving one of our valuable food plants. The basis of this remedy is to return the potato to the conditions of its old Andean home where it grew in cool, shady mountain valleys with its roots invaded by mycorrhizal fungi. Taken out of this environment, it lost its fungi (although it retained its tuber-forming habit) but became a prey to various degeneration diseases. Such maladies resulted in weakened plants and low yields. The only possible remedy was to return to the starting point and develop a new species from seed. The high altitude with its low temperatures and the humus-rich soil contributed to the vigor resulting from hybridization. Isolation in small plots high up in the mountains prevented infections from diseased plants by sucking insects. The results in France have been highly favorable and plant breeders and plant pathologists might apply the same principles not only to the potato but to other plants.

Registration of Organic Gardening Clubs

If you have not already done so, register your Organic Gardening Club with the Managing Editor by sending in the name of the club, names of the officers of the club, place and date of club meetings, activities of club, names of members of your club who can give lectures to other clubs, and indicate ways in which the Magazine can be of help to your club. We want to be of service to your club.

BOTANY
for the Organic Gardener (4)

By DR. WILLIAM H. EYSTER

Plants Of The Sea

THE organic gardener cannot help but wonder what becomes of the vast amounts of top soil that are washed out of their gardens and farms and carried away by the streams which eventually reach the sea. The water-soluble constituents of the soil are dissolved in the water which drains from the land and are delivered into the sea. This represents a one-way trip since the water which passes into the atmosphere from the surface of the sea, in the form of vapor which sooner or later is precipitated on the land as rain or snow, leaves the minerals in the sea. The water which falls on the land again has its pockets empty and again picks up minerals and carries them to the sea. This happens each time water of precipitation dissolves the minerals out of the soil and drains into the streams. As a result of this one-way trip of minerals, the sea is gradually becoming more and more salty.

The waters of our oceans represent a solution in which minerals are dissolved in varying amounts. Since the water of our streams always carries minerals in solution into the sea and since the water which evaporates from the surface of the sea never returns any of the minerals to the land, it follows that at some time in the future much of the available minerals will have been carried to the sea.

The fresh-water streams are inhabited by *green algae,* referred to briefly in a previous number of this series, and such seed plants as the water hyacinth which absorb and utilize some of the minerals which are dissolved in the water. Most of the fresh-water algae are used as food by animals, but the water hyacinth grows in such profusion that it may become an obstruction to the stream. These plants are rich in nutrient materials and are an excellent source of plant materials for composting. One reader wrote to me recently that he has enough water hyacinths available to make a million tons of compost. The water hyacinth is Nature's way of recovering plant nutrients from the waters of our streams. By utilizing them, the organic gardener is recovering precious plant nutrients which are so essential to maintaining the fertility level of our soils.

Sea water, which is a solution of water and minerals in great dilutions, is an excellent medium for the growing of certain kinds of plants. Growing plants in water culture is called *hydroponics* by the plant physiologists. The oceans are Nature's hydroponic tanks or, expressed more simply, Nature's water culture tanks. Most of Nature's hydroponically grown plants belong to the great group of plants known as the *algae.* The algae of the sea are divided into three great

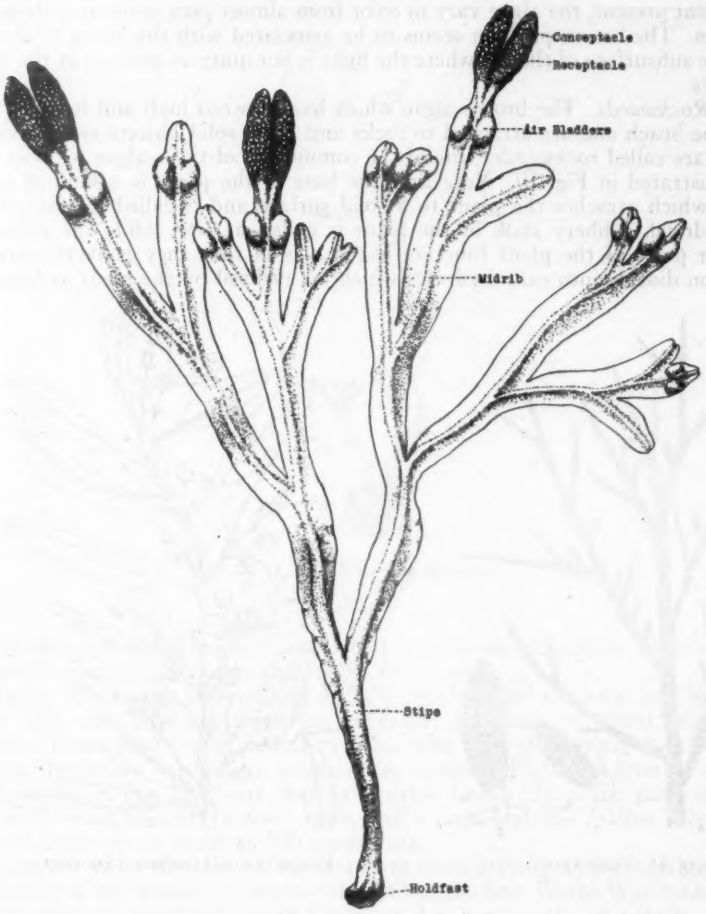


FIGURE 10 FUCUS (ROCKWEED)

sub-groups as follows: 1) the green algae which inhabit the surface waters, 2) the brown algae which live in the subsurface waters of the sea and on the beaches between high and low tide water levels, and 3) the red algae which inhabit the deeper waters of the sea.

The green algae have already been described briefly in the foregoing article. As pointed out there, they are collectively called *plankton* and constitute the first link in the food chain of the animals that live in the sea. Most of the green algae in the sea are microscopically small but are present in such vast numbers that the water assumes a green appearance.

Brown Algae

The brown algae may be studied at first hand on the beaches of many countries of the temperate zones. They contain the same pigments as other plants but have also a brown pigment. Depending upon the amount of brown

pigment present, the algae vary in color from almost pure green to a deep rusty brown. The brown pigment seems to be associated with the living of the algae in the subsurface of the sea where the light is not quite as great as in the surface waters.

Rockweeds. The brown algae which live between high and low tide levels on the beach and are attached to rocks and other solid objects as wharves and piles are called *rockweeds.* One of the commonest of these algae is *fucus* which is illustrated in Fig. 10. Note that the base of the plant is a kind of suction disc which attaches the plant to a solid surface and is called a *holdfast.* The cylindrical, rubbery stalk of the plant is called a *stipe,* while the ribbon-like upper parts of the plant function like leaves in that they convert water and carbon dioxide into carbohydrates which are utilized by the plant as food. The

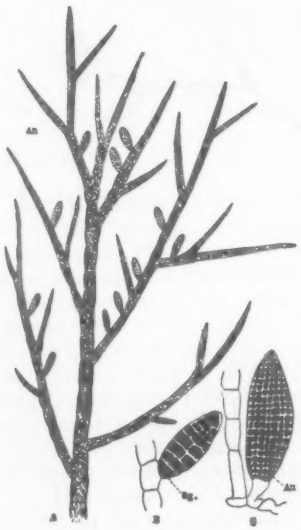


FIGURE 11 ECTOCARPUS

FIGURE 12 GULFWEED (SARGASSUM)

swollen tips of the plant are the reproductive structures which produce eggs and sperms which fuse and grow into new plants. It is also worth noting that the plant has paired *air bladders* which make it buoyant and thus protect it from being ground to bits on the rocks by the restless waters of the seashore.

Another common brown algae is *Ectocarpus* which is shown in Fig. 11. This plant consists of a branched filament made up of cells joined end to end. The short balloon-shaped lateral appendages are the fruiting structures.

Gulfweed. The commonest brown alga in the warmer waters of the ocean is called *gulfweed* or *Sargassum.* The structural characteristics of this alga are shown in Fig. 12. Here again the algal body consists of a holdfast, a rubbery stipe, and leaf-like thallus segments as in *fucus.* The air-bladders, however, have the appearance of small cherries.

Gulfweed grows along the Atlantic Coast of the United States and often is torn loose from its mooring and is carried out to sea by the Gulf Stream. It is because of this that it is called *gulfweed.* The ocean currents carry it in large amounts among the islands of the West Indies, and thence out to sea where it may float around in great eddies to form the so-called *Sargasso Seas.* It is

FIGURE 13 FAN KELP (LAMINARIA)

because this alga occurs in these seas that it is called *Sargassum* by botanists, or perhaps the *Sargasso Seas* owe their name to the alga.

Kelps. The largest brown algae are collectively called the *kelps* and include ribbon kelp, vine kelp, bladder wrack, henware, sea colanders, giant kelp, and fan kelp. These plants are familiar to those who visit the various beaches, as they are frequently washed up on shore by storms. The basal part of a fan kelp is shown in Fig. 13. Note that as in other brown algae, the parts of the plant body are a holdfast, a short stipe, and a large leaf-like thallus. Some of the giant kelps are as much as 300 yards long.

In recent years the algae of the sea have been playing an increasingly important role in our modern economic life. When the first World War broke out we were entirely dependent upon Germany for our supply of potash. This condition led to our utilization of the giant kelps as sources of potash and such other essential materials as iodine, acetone, and kelpchar. When the war emergency had passed, the Pacific Kelp Industry devoted itself to the production of peacetime products from these kelps. One of the most important of these is *algin,* a colloidal substance which is used in the processing of many foods and medicines. It is used as a stabilizer of ice creams, fruit ices, paints, and shellac. It is used as a carrier of vitamins and sulfa-drug compounds. It serves as a base for greaseless, water-soluble ointments and lubricating jellies. Algin is used also as a binder, emulsifier, gel-former, and bodying agent in the cosmetic industry. It makes possible the production of standard preparations of controllable consistency which are transparent and almost odorless. The viscosity of cosmetic preparations may be controlled by the use of algin.

In the rubber industry algin is used as a creaming agent to separate the rubber from the serum which is drained off as a waste product. Compounds of algin are used by dentists for coating dentures. It is used as a clearing agent in the fining of beers and ales and for the purification of beet juices in the manufacture of sugar. In modern steam plants algin is used in eliminating the scale-

forming salts in boiler feed water. It reacts with calcium and other scale-forming metallic ions in hard water to form a soft sludge which can be blown out of the boiler at regular intervals. In the manufacture of leather algin is used to give the leather a desirable gloss and stiffness. It is used in many other industries but enough have been mentioned to illustrate how exceedingly important may be the products of the sea. We have just begun to utilize the almost limitless plant life of the sea.

Kelps are made into tablets to supply the body with certain elements which are deficient in our modern foods because they have been leached out of the soil and carried off to the sea as already pointed out.

Many island peoples use kelps for food. A well known Japanese food made from kelp is *kombu*. In the United States whole unprocessed kelps are not fed to animals but are used quite extensively in processed form as stock feeds. These feeds contain vitamins A, B, F, and G and many elements which are essential to animal nutrition.

Kelps have long been used to fertilize agricultural lands. Some people along the New England Coast have harvested more than a score of varieties of brown algae to be used as natural fertilizers for 300 years. Kelps supply the soil with the valuable trace elements which have been leached out of the soil as a result of bad agricultural practices.

(EDITOR'S NOTE:—The next article in this series will be concerned with the red algae which live in the deep waters of the sea. Interested readers may send specimens of algae to the editor for identification.)

Mushroom Growing with Radiant Heat

At one time it was believed that darkness was the most important requirement for the successful growing of mushrooms. This belief doubtless was due to the fact that mushrooms could be raised so successfully in cellars and in caves in the absence of light. It has since been learned that uniform favorable temperatures and protection against drafts are the prime requisites for mushroom growing. These favorable conditions are now being provided by installing a radiant heating system in the cement floor of the growing houses. This consists of wrought iron pipe coils fabricated in the form of grids. Hot water from an oil-fired boiler is forced through the coils. The temperature of the concrete is raised and heat rays, emanating from the floor, warm everything they touch. This method of heating the houses enables the grower to maintain a constant temperature without producing drafts and without "baking" the moisture out of the air. The lowermost bed grows mushrooms as well as the other beds and in this respect radiantly heated houses are better than those heated by the conventional method.

Market Grower Journal, December, 1947.

The Soil and Health Foundation

I am happy to announce that several projects have been launched in the program of research for the SOIL AND HEALTH FOUNDATION. Experiment No. 1 is being performed by Dr. Ehrenfried E. Pfeiffer at his laboratories at Threefold Farm, Spring Valley, N. Y., and its purpose is to discover whether cancer in mice can be arrested by feeding them food produced organically. The mice that have been secured for this purpose develop mammarian cancer to the extent of 80% or more. The effects of the two types of feeding upon the development of cancer are to be compared. A study will be made to see whether cancer development is influenced by food. Some medical authorities believe this to be the case.

The mice will be bred for three generations, split in two groups, one with food grown with chemical fertilizer, the other with organically grown food. These mice, 80% of which usually develop cancer because they have been bred specifically for that purpose, will be watched to see whether the cancer occurrence declines. It will take a little more than one year to raise the three generations and to arrive at conclusive results.

Should the experiments with mice show promising changes in weight, state of health, etc., a second series of tests could be started by introducing artifically infectious diseases and testing the resistance. These experiments could be started with the second generation of the stock group of either food system and continued for several generations. Mortality is to be recorded as well as pathological investigations made, autopsies, etc. so as to establish the cause of illness and death.

We are fortunate in being able to secure Dr. Pfeiffer for this work. He has received an honorary M. D. degree from Hahnemann Medical College of Philadelphia for his sensational discovery of a crystallization test in diagnosing disease, including tuberculosis and cancer. There will be more about this later. Dr. Pfeiffer has volunteered his services to the foundation without charge, payment to be made only for actual other expenses incurred. This is an exciting project and I am sure all our readers will await the outcome of the tests with keen interest. Above all, the experiments will be carried out on the highest scientific plane so that the results will have to be accepted by the medical and scientific world.

Several other experiments which will be described later are already under way at present in our own greenhouse. Contributing members of the Foundation will receive detailed reports on each one. Many generous contributions have been received. At the present time there is only one type of membership with an annual contribution of any amount the member chooses to make. The amounts thus far have ranged from 40 cents to $1,000.00.

Send contributions to:

SOIL AND HEALTH FOUNDATION
46 South West Street, Allentown, Pa.

J. I. RODALE.

On The Organic Front

By DR. WILLIAM H. EYSTER

CONFERENCES ON BIO-DYNAMIC FARMING METHODS

The autumn 1947 number of *Biodynamics* published by the Biodynamic Farming and Gardening Association, Inc., includes reports of the spring and autumn conferences of the Association held at Threefold Farm, Spring Valley, New York. Most of the discussions were concerned with soil conservation and soil in relation to health. In organic farming practice it is necessary to distinguish between organic matter in the soil and humus. Organic matter includes all plant and animal remains and is as heterogeneous as the many different kinds of plants and animals. Humus, on the other hand, represents a specific state of organic matter. It is a mixture of organic material in a certain living state with minerals and water. It is produced by nature and is stabile.

It appears that organic deficiency is at the base of our modern soil problems . In view of this it is clear that we have been mismanaging our soils, and unless we adopt a practice that involves an increase in the organic matter in the soil, we will not be able to hold the soil or bring it back to its original fertility.

Dr. Pfeiffer discussed the relation between soil and health, and again emphasized the fact that to control the problems of health and the prevention of disease we must control the production methods used in growing our foods. For example, "if a soil is too acid and thus lacking in the proper microbe life, it will produce a lot of cellulose and lignin in the plants (as a result of the fungus life in the soil) but will not give enough nourishing proteins. Little or no attention is paid to this phase of the subject by the usual research station."

Dr. Pfeiffer pointed out that the use of mercury salts for the treatment of seeds is a common practice, but a rather dangerous one. Experiments show that artificial sterility can be produced by feeding mere traces of mercury; and it has been found by test that where seeds are treated with mercury, this gets into the grain and can be recovered in the harvested wheat. In soils rich in humus, these poisons are absorbed by the humus. As a matter of fact, Dr. Rudolph Steiner recommended that leaf mold and colloidal humus be added to soils containing metallic poisons to protect the foods from these poisons.

The difference between humus and organic matter in the form of green manure was emphasized by Mr. Ernest Daniel of Threefold Farm who called attention to the well known fact that cows do not eat grass fertilized by their own droppings, and when they do they commonly become diseased.

The lectures of three physicians are summarized by the statement that man stands at the crossroads and must now choose between a wholly artificial world including artificial foods or a natural world with foods grown by Nature's methods. Man is what he eats. This fact becomes impressive when one studies the nutrition and the health of the different peoples of the earth.

The autumn conference was devoted

to demonstrations and informal discussions. Particular attention was given to soils and the making of compost.

—o—

POCKET-SIZED HORTICULTURAL JUNGLE ON PAIR OF CITY LOTS

According to the San Jose *Mercury-News* for Sunday, September 28, 1947, Mr. D. B. Seale has converted a pair of city lots in Los Gatos into a veritable horticultural jungle. He attributes his success to organic fertilizers which he claims in three years have enabled him to bring his garden into the fullest production. Although the garden "experts" told him that he would not be able to raise the big Stark Double Red and Golden Delicious apples which he was accustomed to in Watsonville and Visalia, he planted the trees and is now reaping abundant crops from these trees. At the County Fair he won first prizes for his Golden Delicious apples, for his lemons, and for his Golden Jubilee tomatoes. "The secret of success," he says, "lies in the compost heap where I put every bit of vegetation that doesn't go onto the table. I use absolutely no chemical fertilizer, and, in fact, I believe those synthetic plant foods are injuring the human race."

—o—

A PROFESSOR TALKS ABOUT HEALTH

In a recent issue of the Boston *Sunday Herald* was given a forum concerned with questions on various garden practices and answers by Professor Koon, Head of the Waltham Field Station of the University of Massachusetts. One reader asked the professor whether he thinks it is true that the use of chemical fertilizers, instead of compost, to grow our crops is responsible for the great increase in human diseases in this country. The reply was, "I think it's bunk! What increase in human disease? I believe we are the healthiest nation on earth and becoming more so all the time. If we had to depend solely on 'compost' now as a source of plant food we would all but starve to death." The professor's answer does not check with Mr. Seale's horticultural jungle which covers only two city lots and provides all the food for Mr. Seale and his family. A casual study of the health examinations of our young men drafted into our armies at the outbreak of the recent war hardly bears out Prof. Koon's statement that we are the healthiest nation on earth. There are plenty of degenerative diseases that are becoming more and more prevalent in both crop plants and man. There is much evidence at hand to indicate that they may be due to deficiencies in the soil.

—o—

EROSION SLASHES PRODUCING POWER OF SOIL IN NEW JERSEY

According to *News and Views* gathered by The Coke Oven Ammonia Research Bureau for November, 1947, the farmers of New Jersey are finding that their "past is catching up with them." Data on the yields of certain crops show the effect of past erosion on the crop producing power of the soil and the response to fertilizer. The data show that uneroded soils are consistently more productive than eroded soils. Eroded soils are defined as those which have less than six inches of surface soil containing organic matter, while uneroded soils are defined as soils having six or more inches of surface soil containing humus. No data are given on the effect of artificial chemical fertilizers on the soil organisms or on their capacity to incorporate plant and animal residues and to convert them into humus in the soil.

Skunk Cabbage

(Symplocarpus foetidus)

By DR. WILLIAM H. EYSTER

COME with me to the swamp in February and I will show you the first flowers of spring. While other plants are still in the deep sleep of winter, the skunk cabbage boldly pushes through the still frozen ground its flower structure. This consists of a purplish shell-like leaf, called a spathe, which shelters and protects the flower stalk having the general shape of a drum stick. This fleshy flower stalk is called a spadix. The head of the spadix bears many small, inconspicuous but perfect florets. Thoreau referred to the skunk cabbage as the "hermit of the swamp." To those who were inclined to become depressed as the days shortened and the nights lengthened he suggested a trip to the swamp to "see the brave spears of skunk cabbage buds already advanced toward a new year." It requires only a few sunny, spring-suggestive February days for the spathe of the skunk

SKUNK CABBAGE—"HERMIT OF THE SWAMP."

cabbage to attain its full height of four or more inches. The spadix develops equally fast and its perfect flowers are soon in full bloom. This rapid growth requires a great deal of energy which is released in respiration. The heat of respiration causes the interior of the spathe to have a temperature higher than that of the chilly February air. Insects which are on the wing in February use the spathe of skunk cabbage as a heated tourist cabin in which they find a comfortable lodging during nights and on cold days. How much do they pay for their lodging, you may ask. Quite unsuspectingly they pay for their lodging. By going from the spathe of one plant to that of another, these insect guests carry the pollen from one plant to another and thus cross-pollinate the plants. This results in the fertilization of the eggs in the ovules and the setting of seeds. The ovary of each flower that is fertilized ripens into a red berry. The fruits become exposed as the spathe decays and falls away from the spadix which bears the fruits.

While the fruits are ripening and the February days give way to the sunnier and warmer days of March and April the large, bright-green, veiny leaves give to the swamp the appearance of a cabbage patch, hence the name swamp cabbage.

You may wonder why such a daring and adventurous plant has such a disagreeable odor, for its bruised tissues have an odor similar to that of a skunk. The reason is that this plant depends upon other organisms than man for its survival. Cattle which seek so eagerly the green bite of early spring let the plant alone because of its stinging acrid juice. Lizards make their home beneath the plants, and the yellowthroat gladly builds her nest in the hollow of the cabbage where the odor protects her and her young from furry animals which give the skunk a wide berth. Yes, the odor is without doubt an asset to the skunk cabbage.

A SKUNK CABBAGE PLANT

In our attempt to understand plants and animals we must be careful to remember that not all animals get the same stimulus or respond in the same way as man to a certain odor, color, or other environmental factors. Although the carrion flower has the odor of decayed flesh which is disagreeable to man, it is gladly visited by flies which serve it as pollinators. The same may be said of the purple trillium. We may be sure that the odors of these flowers are not repulsive to their flyguests at least.

The skunk cabbage belongs to the same plant family as jack-in-the-pulpit and the familiar calla lily which has a snowy white spathe and a golden spadix.

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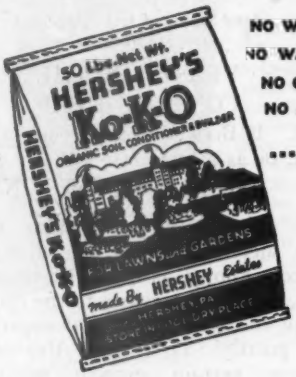

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SUCCESSFUL PART-TIME FARMING by Hayden S. Pearson (Whittlesey House, McGraw-Hill Book Company, Inc., New York, N. Y., 1947. $3.00).

The author has presented a wealth of information on a timely topic in such readable form that the whole family will find pleasure in how to escape the humdrum life of our cities and larger towns. It is possible to retain your position in the city and still enjoy the freedom and security of a country place. Part-time farming will contribute generously to family unity and prevent further erosion of morality and health.

AN INTRODUCTION TO PLANT ANATOMY (Second Edition) by Arthur J. Eames and Laurence H. MacDaniels. (McGraw-Hill Book Company, Inc., New York, N. Y., 1947. $4.50).

This book contains the excellent qualities of the first edition as well as the techniques and results of more recent researches on the cell and the structure of the body of the higher plants. This book is, without question, the best in its field and is a valuable reference book for those working in the different fields of applied botany.

HORMONES AND HORTICULTURE by George S. Avery, Jr., and Elizabeth B. Johnson. (McGraw-Hill Book Company, Inc., New York, N. Y., 1947. $4.50).

This book is supplying a much-felt need in presenting the principles concerned with the use of hormones in the control of plant growth, and in giving a comprehensive listing of the literature in this new and important field. This is an important contribution to the literature of horticulture.

PLANTS AND ENVIRONMENT—A Textbook of Plant Autecology by R. F. Daubenmire (John Wiley & Sons, Inc., New York, N. Y., 1947. $4.50).

This book presents the fundamental principles of plant ecology in a clearly expressed and well organized manner, and is to be commended for the attempts that have been made toward synthesizing the results of researches in various fields of plant biology. The material should prove interesting to the general reader, the gardener, and the farmer as well as to students majoring in the plant sciences.

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Readers' Correspondence

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YEASTS IN THE COMPOST HEAP

Q. Is Brewers' yeast good for compost, or as a fertilizer?

Miss C. T. H., Buffalo, N. Y.

A. Yeasts convert simple sugars into alcohol and carbon dioxide, a process known as alcoholic fermentation. By adding yeasts to the compost heap, the fermentation of sugars will be greatly hastened. Also yeasts secrete certain growth substances which stimulate the growth of other plants.

—o—

NATURAL CONTROL OF DISEASES AND INSECTS

Q. If poisonous chemical sprays and dusts are detrimental to the bacteria and earthworms in the soil, what can I do to prevent my garden from being devestated?

Mrs. J. B. C., Pleasantville, N. Y.

A. Diseases and insect pests are Nature's way of telling us that something is wrong with our cultural techniques or with our soil. The first and most important garden procedure that leads to the control of diseases and insect pests is the practice of sanitation. Clean away all diseased plant parts and such materials as shelter insects during winter. Give each plant, at the time of setting out, a rich application of compost about the roots. Practice mixed plantings, as radishes with squashes because the radishes tend to repel squash bugs; or odorless marigolds with sweet corn as the Japanese beetles prefer the leaves of the marigolds to the silks of the corn ears. An ounce of prevention is

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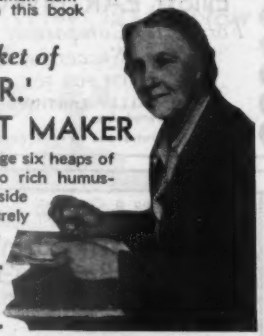

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worth a pound of cure also in insect control. By picking the few adult insects that winter over, the insect problem often can be reduced to a negligible consideration.

—o—

TIMOTHY HAY FOR COMPOST

Q. I have available a lot of timothy hay. Can this be used for making compost?

J. W., Phillipsburg, N. J.

A. Timothy hay, even though it is partly spoiled for feed, can be used for making compost. All kinds of plant material on the farm including weeds, leaves, garden wastes, and processing plant wastes can be used in the compost heap. The more kinds of plant materials used, the more apt the compost is to have all the nutrient materials. Under no conditions should plant residues be burned or otherwise destroyed.

—o—

ROCK MULCHING

Q. What is rock mulching and how is it properly done?

K. C. H., Paulding, Ohio

A. Rock mulching consists of placing rocks between or around growing plants. For example, rock mulching a tree consists of setting rocks in the soil around the tree and as far out as the drip line. It is desirable also to place under the rocks a liberal appli-

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cation of compost and a layer of leaves or other plant materials.

—o—

BEAN WEEVIL CONTROL

Q. I am enclosing beans which I believe to be infested by bean weevils. How may bean weevil infestation be prevented?

C. L. H., Guilford, Vt.

A. Bean weevils attack the matured seeds of beans after they are harvested and put into storage if they have not been properly cured. This can be prevented by curing the beans before they are shelled and stored. When the beans are ready to be harvested, pull up the plants with the pods on them, and put them on stakes, off the ground, to cure. The curing process involves certain biological changes including fermentations and the production of heat; this requires six weeks or longer. The cured beans may then be shelled and stored without danger of weevil damage.

—o—

PREVENT TOOTH DECAY

Q. A friend of mine, a dentist who is quite interested in organic gardening, told me today that he is going to use sodium fluoride on his vegetable garden next year. He told me of a

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dentist who had done this and as a result believes it may have been the reason why his children had not developed tooth decay. What is your opinion of this?

M. T. S., Rochester, N. Y.

A. Do not use sodium fluoride. We believe that fluoride is effective in preventing tooth decay, but feel that it should be applied to the soil in some natural compound as bone meal or phosphate rock. The fluorine content of phosphate rock is quite sufficient to meet the demands of the body in building normal healthy bones and teeth.

—o—

WIRE WORMS

Q. I would like to ask for information as to wire worms with which we are bothered in the vegetable garden on our ranch in Oregon.

Mrs. N. T., Burlingame, Calif.

A. Wire worms are the larvae of click beetles and have a life cycle of from 2 to 6 years. They become troublesome only in soils that have been for a long time in grass. In such soil they are beneficial in converting the old roots of plants into compost. It is a mistake to plant food plants in soil that has been for a long time in sod and has become well populated with wire worms. If an old sod is to be used for growing other plants, time

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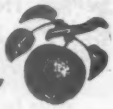

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must be given for the wire worms to clear out.

—o—

FIG TREES TRANSPLANTED

Q. I have a large fig tree that I would like to transplant. Can you tell me how to go about it?

R. S. D., Brooklyn, N. Y.

A. After the leaves have fallen off in the fall, dig a trench around the tree in such a way that a large ball of earth remains on the roots of the tree. This ball of earth should have the shape of an inverted cone. The cone-shaped ball of earth containing the roots of the tree can then be lifted out of the earth and carefully placed in a hole previously prepared at the new site where the tree is to grow.

—o—

WEEDS FOR THE COMPOST HEAP

Q. Are weeds suitable for making compost for the garden?

A. G. R., Lancaster, Pa.

A. Weeds are excellent plant material for the compost heap as many

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of them take essential elements from the deeper soil horizons and thus make them available to the shallow rooted crop plants. The biodynamic method of making compost involves the using of such weeds as dandelion, camomile, nettle, and scouring rushes.

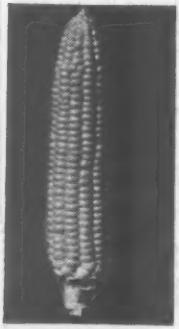
—o—

WATER HYACINTHS FOR COMPOSTING

Q. It occurred to me that I might use water hyacinths, which could be easily obtained, for composting. I have enough of them on my place to make a million tons of compost. Do you recommend them for the making of compost?

C. H. S., Leesburg, Fla.

A. Water hyacinths are Nature's conservers of minerals in streams that are draining our fertility from the land into the sea. They are 93.4% water and 6.6% dry matter. The nitrogen content of the dry matter is 2%. The ash includes 4% phosphoric acid, 11.2% potash, 5.6% magnesium, 8.5% calcium, and 39.1% insoluble residue. So you see, water hyacinth is a most valuable plant for composting. It involves the reclaiming of plant nutrients that are being drained into our streams and eventually the sea and forever lost to the soil.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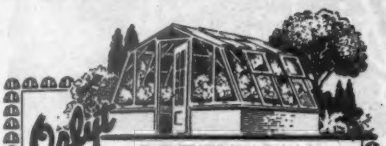

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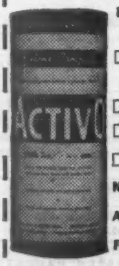

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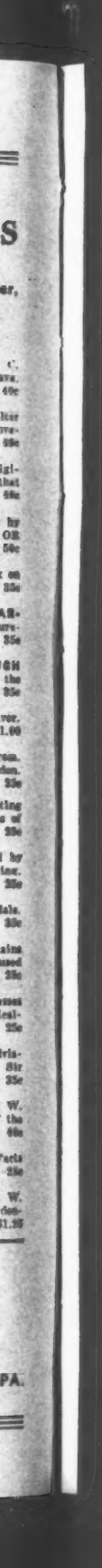

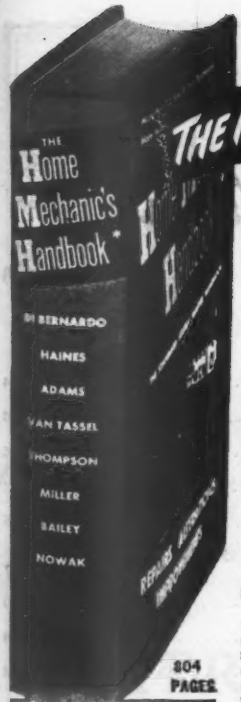

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